FLYING

HERE'S *How* TO RUN AN AIRPORT

See page 35

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The High Way needs no Pavement

From its first chugging start, the automobile had inherent utility. But it took forty *billion* dollars, spent to build 3,038,000 miles of highways, roads and streets, to extract the vehicle's full use.

The airplane, with all of its inherent utility, needs no similar sum. Post-war construction plans, totaling between one and two billion, will go far towards making a world-wide air transport system available to any community in any location.

Lower air fares and cargo rates in the future will increase the value of such air transport to each city and nation. Reduced rates will result both from traffic gains and new equipment. Wright Aeronautical is helping to make such rates a reality by constant improvements in aircraft engines, by building engines that pay their way in use.

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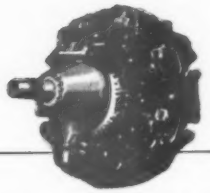
Paterson, New Jersey, U. S. A.



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LOWER FUEL CONSUMPTION
REDUCED MAINTENANCE

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A Division of
CURTISS-WRIGHT CORPORATION

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FLYING

JULY, 1945

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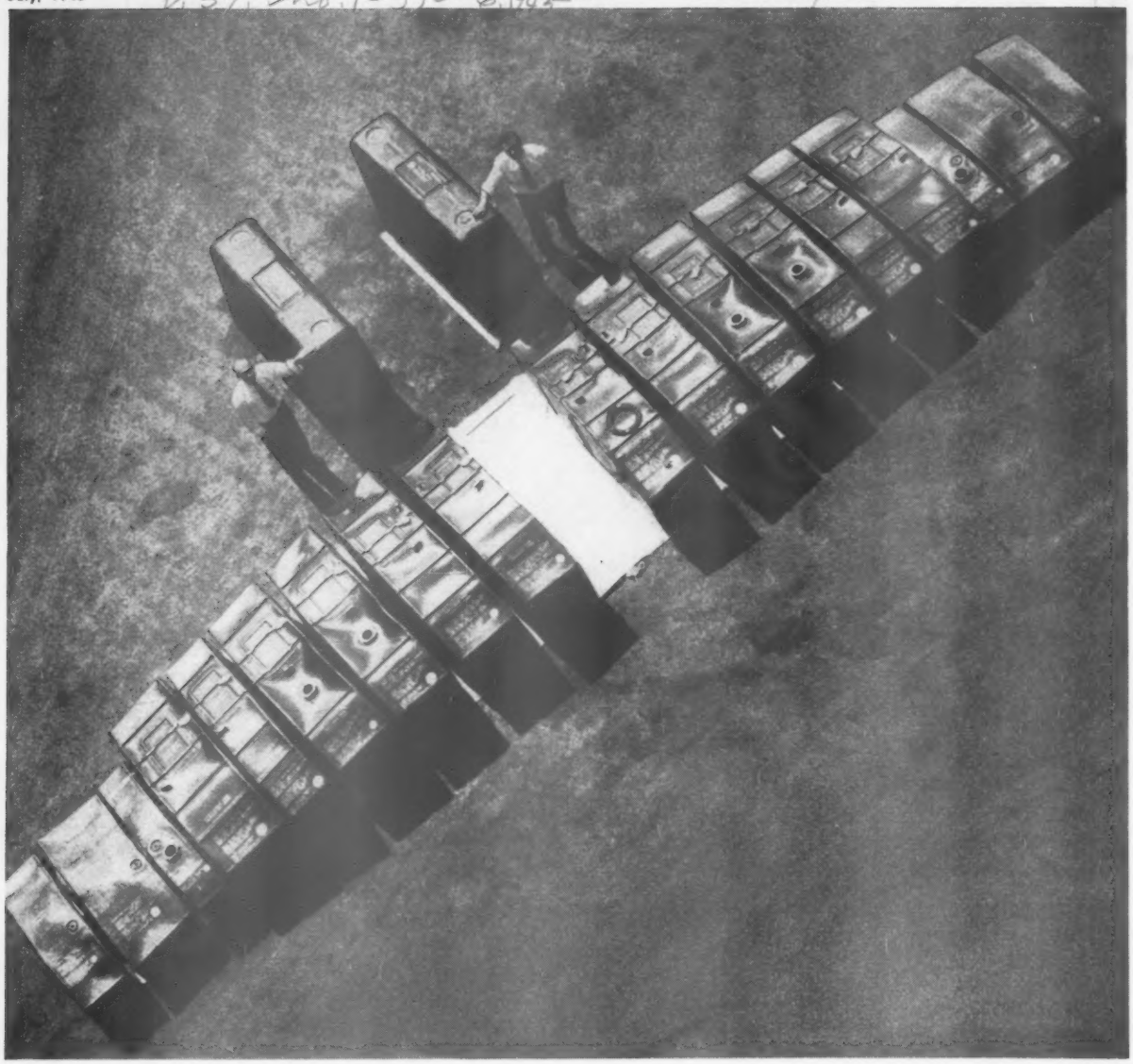

Airplanes carry gasoline in rubber suitcases

WHEN the crew chief of a Consolidated "Liberator" says, "Fill 'er up," here's what they fill. These gas tanks are arranged exactly as in the plane's wings. They look like this because they were designed to "eat" bullets and get away with it.

B. F. Goodrich makes them to seal so fast only a few drops of gasoline can leak out! They can take .50 calibre machine gun slugs, incendiaries, even small cannon fire, without exploding.

The tank wall is the secret. It's sort of a triple-decker sandwich of synthetic rubbers and fabric. Some of these layers are resilient enough to be pushed *aside* rather than *out* when a bullet goes through. They spring back in place after it's past.

Any hole still left at this point is sealed by the very act of gasoline starting to leak through. For one of the special layers (called the sealant) swells when gasoline touches it, and this instantly closes the puncture.

B. F. Goodrich engineers pioneered many of the developments that led to today's life-saving bullet-sealing fuel tanks. They make oil tanks that seal the same way . . . gasoline hose, too. Intimate knowledge of synthetic rubbers made all these possible.

Many other B. F. Goodrich aircraft products reflect unusual synthetic rubber experience. Among them molded engine parts that resist oil and stand up under extremes of heat and cold; expander tubes for brakes that stop planes efficiently in the Arctic or the tropics; even the largest airplane tires are now made principally of synthetic rubber.

They're part of a family of more than 80 rubber parts that carry the name B. F. Goodrich wherever rubber flies. The B. F. Goodrich Company, Aeronautical Division, Akron, Ohio.

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AIR FORCE FOR SALE

By JOAN DAVID

RFC will sell billions of dollars of surplus flying materiel to qualified schools at fantastically low prices.

YOU can buy a Link Trainer or a *Flying Fortress* for $350, a Douglas *Skytrain* or a Lockheed *Hudson* for $150, a glider for $50, a 1,600-h.p. Pratt and Whitney radial engine for $10, an altimeter for $1. That means that a *Lightning* at $150, or a *Mitchell* at $200, costs you less than one-twentieth of what crating and shipping charges on those planes would be from Los Angeles to Chicago—$3,200 and $4,500 respectively.

Yes, it's true—but there are strings attached. These are the prices at which the Reconstruction Finance Corporation has been authorized by the Surplus Property Board to dispose of a major part of our enormous aviation surplus. Beneficiaries under the plan, which took effect May 10, 1945, are some 30,000 U.S. schools and colleges which can meet the terms imposed by the regulation.

Justification for this dramatic action is contained in Section 13 of the Surplus Property Act of 1944. In permitting the sale or lease of "surplus property that is appropriate for school, classroom, or other educational use . . . to tax-supported educational institutions and to other nonprofit educational institutions . . . exempt from taxation . . . under the Internal Revenue Code," the Act requires that in fixing prices the Board *"shall take into consideration any benefit which has accrued or may accrue to the U.S. from the use of such property* by any such . . . institution."

545313

Eligible under the rules, therefore, are every secondary school, every tax-free college or university, the Boy Scouts, YMCA's, state-sponsored rehabilitation or vocational schools—even prison schools.

The Surplus Property Board's Regulation No. 4 on "Disposal of Surplus Aeronautical Property to Educational Institutions for Non-Flight Use," requires that the educational institution acquiring the property shall certify in a notarized certificate that the property is to be used only for non-flight instructional, research, or experimental purposes; that it will not be used for flight purposes, and that it will be sold only as scrap and then only after it has been made completely unfit and useless for its original purposes.

SPB's chairman, ex-Sen. Guy M. Gillette of Iowa, explains: "We are fully aware that air power is founded on technical knowledge. . . . We plan to distribute aircraft and parts to schools and colleges throughout the nation for classroom and laboratory use. It is the Board's desire to make surplus disposal a positive instrument for advancing the excellence of American aviation."

The Board's action was not entirely unprecedented. The Army and Navy, by virtue of Acts of Congress passed in the '20's, had channeled a moderate amount of obsolete and non-reparable equipment to approximately 7,000 schools. Some got just a single item, such as an engine. A few were fairly well equipped. The program gained momentum with World War II and, during this past March alone, $9,000,000 worth of aeronautical equipment was given away by the Army, most of it to schools providing Government-sponsored war training. By that time, however, the value of surplus aeronautical property was well over a billion dollars and promises to be several times that before the final tally is in.

The largest amount of aeronautical surplus is by far the least marketable. Com-

An engine like this single-row radial having a cylinder installed at the Shelby County

Old bombers, like these Lockheed Hudsons at the Shelby County school, now can be bought by similarly qualified schools for a nominal price.

School of Aeronautics, originally cost thousands of dollars. The SPB price to the school is only $10.

Proper tail section rigging, an important phase of airplane structure, can now be taught classes similar to those at the Shelby school, illustrated above.

TYPICAL SURPLUS PRICES

AIRCRAFT

Name	Price
Douglas Havoc	$150
Douglas Dauntless	100
Curtiss Helldiver	100
Lockheed Hudson	150
Grumman Avenger	100
Martin Mariner	200
Boeing Fortress	350
North American Mitchell	200
Consolidated Coronado	350
Beechcraft Traveller	100
Curtiss-Wright Commando	200
Douglas Skytrain	150
Sikorsky Excalibur	350
Chance Vought Kingfisher	50
Curtiss Seahawk	50
Grumman Goose	150
Grumman Widgeon	150
Lockheed Lightning	150
Republic Thunderbolt	100
North American Mustang	100
Northrop Black Widow	150
Grumman Hellcat	100
North American Texan	100

ENGINES

Name	Price
Warner R-500 (165 h.p.)	$ 10
Wright R-1820 (600-1,000 h.p.)	10
Pratt & Whitney R-2800 (1,550-1,675 h.p.)	10
Lycoming O-145 (65 h.p.)	10
Packard V-1650 (2435 h.p.)	10
Allison V-1710 (2150 h.p.)	10

ACCESSORIES, ETC.

Altimeter	$ 1
Carburetor	3
Gyro Flux Gate and Compass	1
Remote Indicating Compass	1
Magnetos	3
Propeller (four-blade, except counter-rotating, hydraulic control, electric control)	15
Propeller (counterrotating, hydraulic control, electric control)	15
Link Trainer (18'x22'x10')	350

bat planes (war-weary or obsolete), plus the spares which were made for them, form a large part of it. In addition, there are so many marketable items that all cannot be sold. The so-called "Pogue Report" on Surplus Aircraft Disposal (submitted to ex-surplus Property Administrator Will Clayton by a committee headed by Civil Aeronautic Board's Chairman L. Welch Pogue) pointed out the vastness of the supply:

"After all the aviation needs for surplus aircraft have been met, we believe it probable that large surpluses will remain. Markets and uses for these remaining surpluses will exist in educational, experimental, memorial, and miscellaneous non-aviation uses. We urge every possible meritorious utilization. But even after all conceivable needs and uses have been met, surpluses will remain."

Since adapting the aviation industry to a lot of outmoded planes-on-hand would practically stifle its development, non-aviation uses were sought. A number of planes were dismantled to determine what use might be made of the components, and to find out whether such salvage work would be economically worthwhile.

One of the guinea pigs was a war-weary *Liberator*. After 783 man-hours (at a conservative $1 - an - hour) the 32,759 pounds of engines, airframe, armament, rubber, propellers, landing gear, hydraulic mechanisms, radio and electrical equipment was spread out for the salvage experts to judge. Only one part proved saleable—as souvenir ashtrays! The rest was classed as scrap, useful only after it had been melted down.

The main danger was that much of this surplus would be retained for years in Government warehouses in the hope of finding a market for it—and then be sold as scrap. Not only does equipment deteriorate rapidly in storage, but maintenance charges soar. Engines must be turned over from time to time; they must be kept "pickled." Planes must be tied down on airfields and must be checked periodically.

There has been almost-universal approval of SPB's regulation. Military strategists heaved a sigh of relief. "You can't stockpile an airforce," they declare, pointing out a wartime eight-month obsolescence rate for combat planes. The fewer surplus planes we have on hand at the war's end, the more modern our air forces will be.

Aircraft manufacturers, whose jitters at the prospect of a glutted aviation market have cropped out lately into quarter-page newspaper ads, swallowed it like a sedative. The more air-educated young America is, the bigger its potential peacetime demand for planes.

For teachers and students alike, it comes as a windfall. Aeronautical training, on a scale inconceivable a few years ago, now can become a practical reality. For the taxpayer, there is the consoling thought that, despite the 95 per cent or more price reduction, the public is getting a very real return from equipment that would otherwise have been scrapped and written off as part of the cost of war.

The mechanics of distributing this surplus aeronautical equipment to a possible

(*Continued on page* 142)

Flight to Poltava

By Lieut.
ROBERT E. JOHNSTON
Navigator, 8th Air Force, now assigned to AAF Navigation School, San Marcos, Tex.

Nazi bombs made the 8th Air Force's first shuttle mission a one-way trip.

Over the flat Ukraine, these shuttle-bombing Fortresses used dead reckoning alone to reach their designated Russian base.

EARLY in June, 1944, the words "top secret" clamped down on our base like an English fog. "Top secret" is a tough phrase in the Air Forces; it means air-tight, talk-tight security and nothing less. To us, it also meant confinement to the base and tightening anticipation of a big job coming up.

Then came a closely-guarded meeting of air crews in the oversized Nissen hut we used for briefing. But still we kept our mouths shut. We were one of the oldest *Fortress* groups in England and we knew that security means lives. On the evening of June 20 we were alerted as usual but this time we had orders to pack B-4 bags with Class A uniform and an issue of special escape kits and identification cards. Very early the next morning we were tense but not surprised when the big map at the front of the briefing room was uncovered and showed the route running endlessly across Europe.

Russia! Once before the 15th Air Force had run a shuttle mission from Italy to Russia and now we were to make further history by a shuttle across all of occupied Europe, bombing deep in Germany and going on to bases in the Ukraine.

The mission started in the routine way except that the preparation of the navigators was an epic of its kind. The flight plan covered two large sheets. We drew courses on some eight mercators extending from 0° to beyond 32° east longitude. To cover pilotage requirements we carried a roll of maps about eight inches in diameter in reserve for missions out of Russia. It was a wearisome load and as I moved slowly out from our locker room to the trucks bearing flying clothes, briefcase, sextant, map-rolls, HO-218 books, musette bag and canteen, I felt like a pack mule and probably sounded like one to my long-suffering pilot. When we got out to the planes we found that one gunner in each bomber had been replaced by a *Mustang* mechanic who had been flown up the night before. It would be the first

---

This is a condensed version of an article entitled "Shtoy" published in *Log of Navigation*, house organ of the AAF Navigation school, Ellington Field, Tex.

Nazi bombs totally destroyed the U. S. Fortresses on the Poltava airfield after they had completed the first shuttle-bombing run between Britain and Russia. To return to London, the crews flew a 10,000-mile circuitous route via Teheran and North Africa.

mission for any of them and they were even more excited than we were. It would be their job to service our *Mustang* escort planes while in Russia.

With the navigators safely stuffed into their planes, we took off. Our target was Ruhland, a large oil refinery northeast of Dresden.

As we moved into Germany, towns ahead of us began to put up smoke-screens, while far to our left we could see the Berlin barrage pounding at other groups and wings assigned to tougher but less spectacular jobs. The day was clear and we bombed visually through an ineffective smokescreen. As we came out of the thick flak, which quite reasonably had upset our mechanic guest-gunner, smoke rose behind us in tremendous billows and we knew we had put them in there solid. Tension relaxed a little but there was still a long way to go.

Map after map came off the roll. All around us our far-flying *Mustang* escort rode steadily. Over Poland everyone was taking things easy and a little bull began to flow on the interphone. Then it happened. Over Brest-Litovsk, cloud cover gave the Germans their tactical chance and like a flash the Me-109's were coming through at us. The first attack was so sudden I found myself shooting a nose-gun from the hip. My bombardier and I hit one, heard the ball turret man say he was spinning in, and as quickly as that the attack was over. But 20-mm. armor-piercing shells had hit us solidly and one of them, coming in over the bombardier's head, had zipped in back of me, demolished my interphone jackbox and the hydraulic lines in the dashboard, pierced a rudder pedal and torn a six-inch piece out of the leg of Hooper, our pilot. Croce, the belly gunner, came up and administered first aid and morphine. We wanted Hooper to let us put him in the radio room but he insisted on keeping his seat and he was boss.

Soon we were past the front lines in Russia and the navigation grew tougher. The Ukraine is a vast ocean of check-point-free forms—similar to our Middle West but with far fewer cities, towns or railroads. Radio aids are almost non-existent; the strange navigator comes down to the bedrock of dead reckoning [DR]. The maps we had, too, were far from complete as we regard maps. We let down slowly and soon Russian peasants could be seen, pausing in the work of

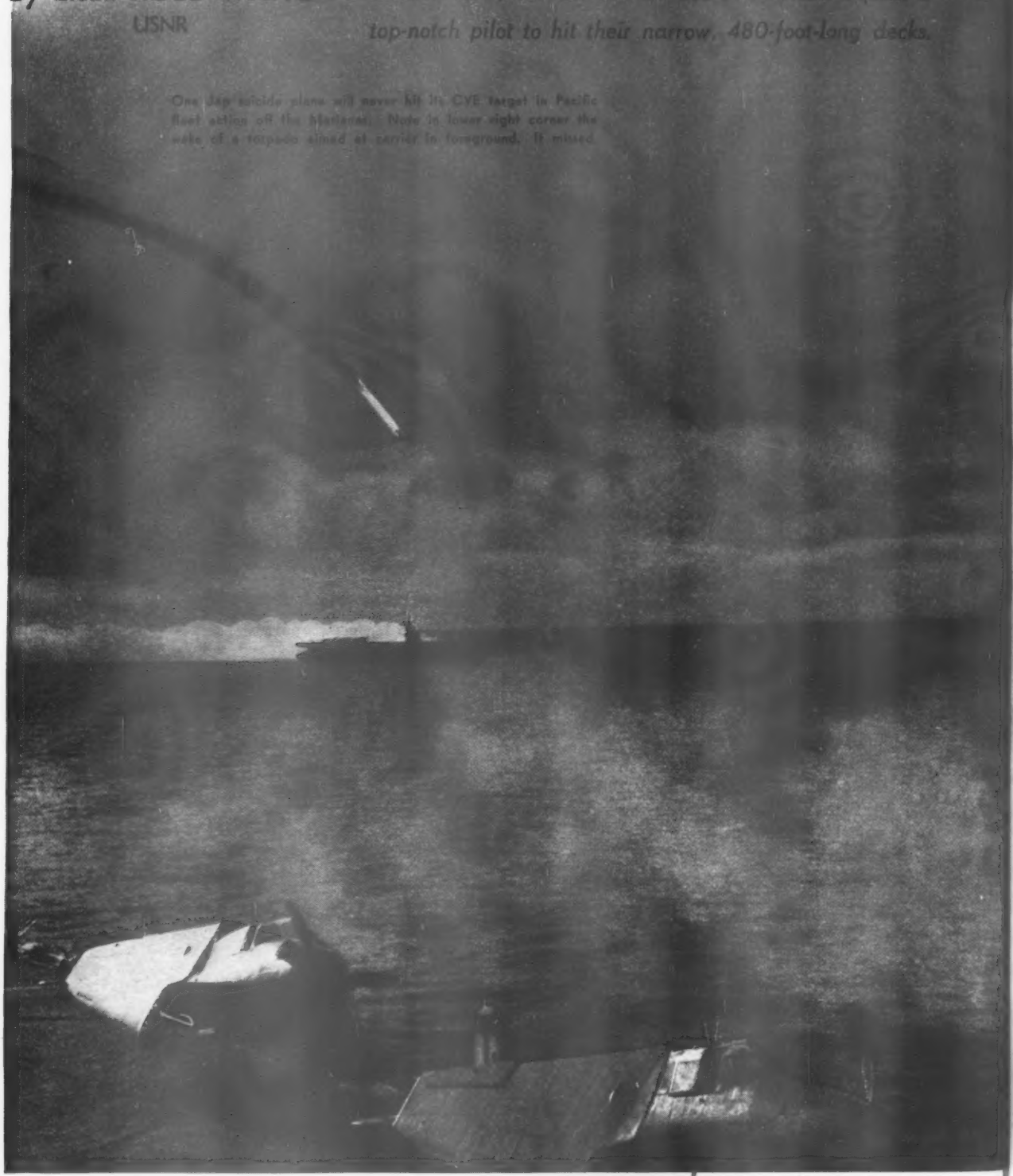
(*Continued on page* 88)

AAF crewmen noted with envy that all Russian KP's were girls. In addition to chow-line duty, the girls served as guards and antiaircraft gun crews. Their homes were railroad box-cars.

LIFE ON AN 'OIL S

The thin-skinned escort carriers are called "tomato cans," but the men on the CVE's know it takes a top-notch pilot to hit their narrow, 480-foot-long decks.

By Lieut. ROBB WHITE
USNR



One Jap suicide plane will never hit its CVE target in Pacific fleet action off the Marianas. Note in lower right corner the wake of a torpedo aimed at carrier in foreground. It missed.

SLICK'

THEIR official Navy title is "Carrier, Heavier-than-air craft, escort;" or, in its reduced form, CVE. They are short, ugly, slow compared with their mighty sisters, the fast carriers of the first line. People call the CVE's "jeep carriers," "baby flat-tops," "U.S.S. Reprehensibles," and "Kaiser Coffins." Some are called "oil slicks" (this because they are converted oil tankers), some "tomato cans" because their sides are very thin.

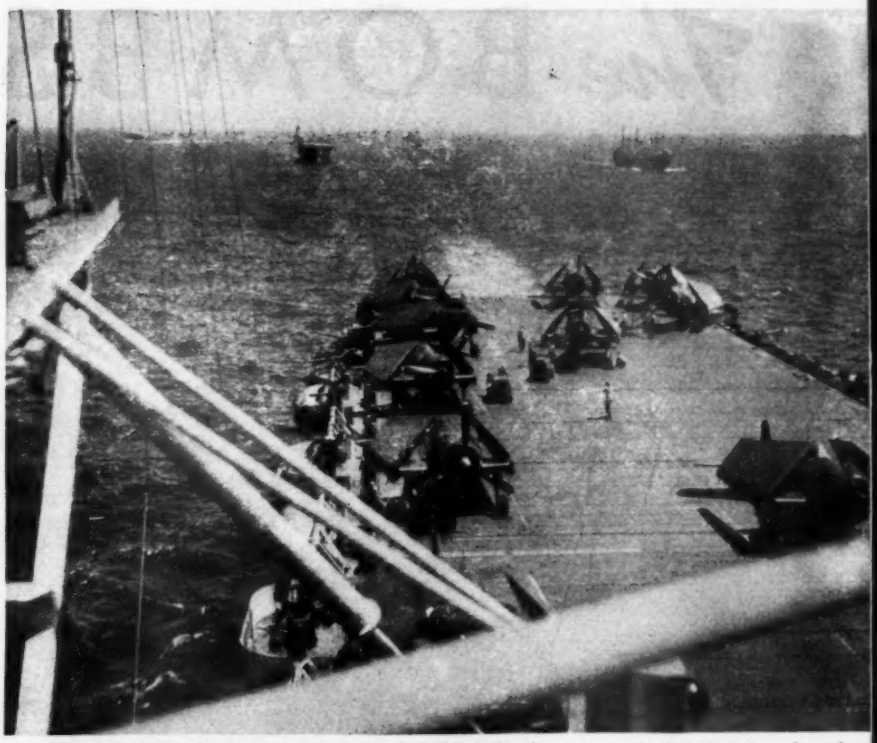
Men serving in these ships bear all such jibes patiently and with dignified resignation. Each nickname conveys some truth. A jeep carrier given to the British sank in something like 52 seconds. The *Liscome Bay* sank off Makin in 1943 in about 27 minutes. Obviously the baby flat tops cannot take a lot of punishment, not because of faulty design or construction nor because of failure on the part of the ship's company to bang away lustily and with all they've got at attacking enemy planes or submarines. They were built as a stop-gap when the Navy desperately needed them. They were intended to be loaded with planes to their gunwales and to transport them to within flying distance of the first-line carriers and there replace the losses of their big sisters. The jeep carriers were thrown together in a matter of months to go as escorts for the Atlantic convoys when the Battle of the Atlantic was grim and desperate and the Nazi subs prowled by scores.

Now these carriers are in the Pacific —out in the big league with ships like the *Enterprise*, and the new *Lexington* and other CV's and the CVL's. At some Pacific base before a push you can see a huge carrier like the *Lexington* moored alongside the abrupt bank of the island, and behind her, as though she had given birth to it, will lie the *Natoma Bay*, awkward and unbeautiful as a new colt. Sailors on the *Lexington* will lean over the fantail and ask those on the *Natoma Bay* if their flight deck is a catwalk. They will want to know "what makes that thing run—squirrels?" And when the *Lexington* pulls away with her grand better-than-30 knots the *Natoma Bay* will be panting and bucking at her much slower speed.

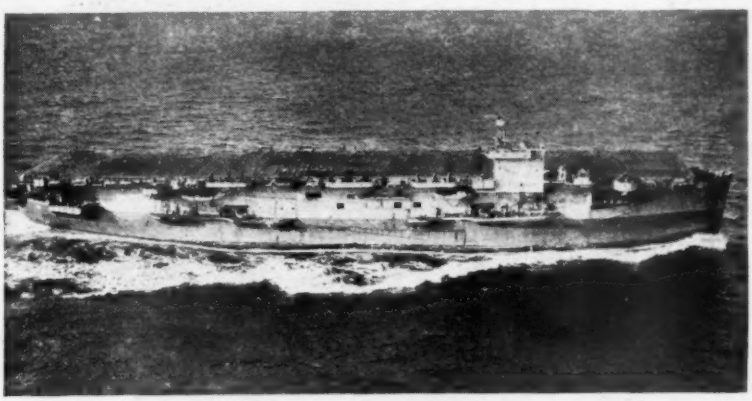
When the push really starts and the troops are hitting the alien beaches, the first-line jobs are steaming proudly around searching those strange seas for the Jap fleet, or any part of it. But the jeeps—they're hanging off the shores of a low island, supporting the troops.

There is no fine turkey shoot for the pilots on the jeeps, no dipping into a big barrel and pulling out a fistful of medals. These glamorous things are for the airedales on the big carriers. There's nothing but hard work for the jeeps, and danger in long stretches—a peculiar, drawn-out and disagreeable danger. However, if the big jobs are away, as they were during

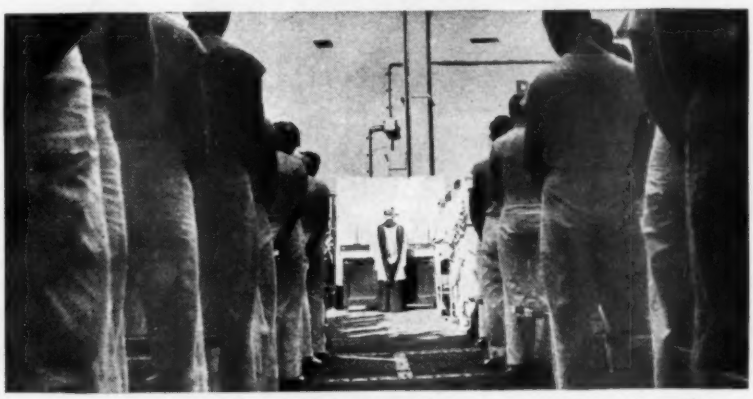
(*Continued on page* 104)



CVE's fight in both oceans. In foreground, heading for the August 15, 1944, invasion of southern France, is the U.S.S. Tulagi. With it is the U.S.S. Kasaan Bay and seven British escort carriers.



The U.S.S. Card, one of the first CVE's, was also the first to get a unit citation. It was converted from a merchant ship hull and launched in Tacoma, November 8, 1942.



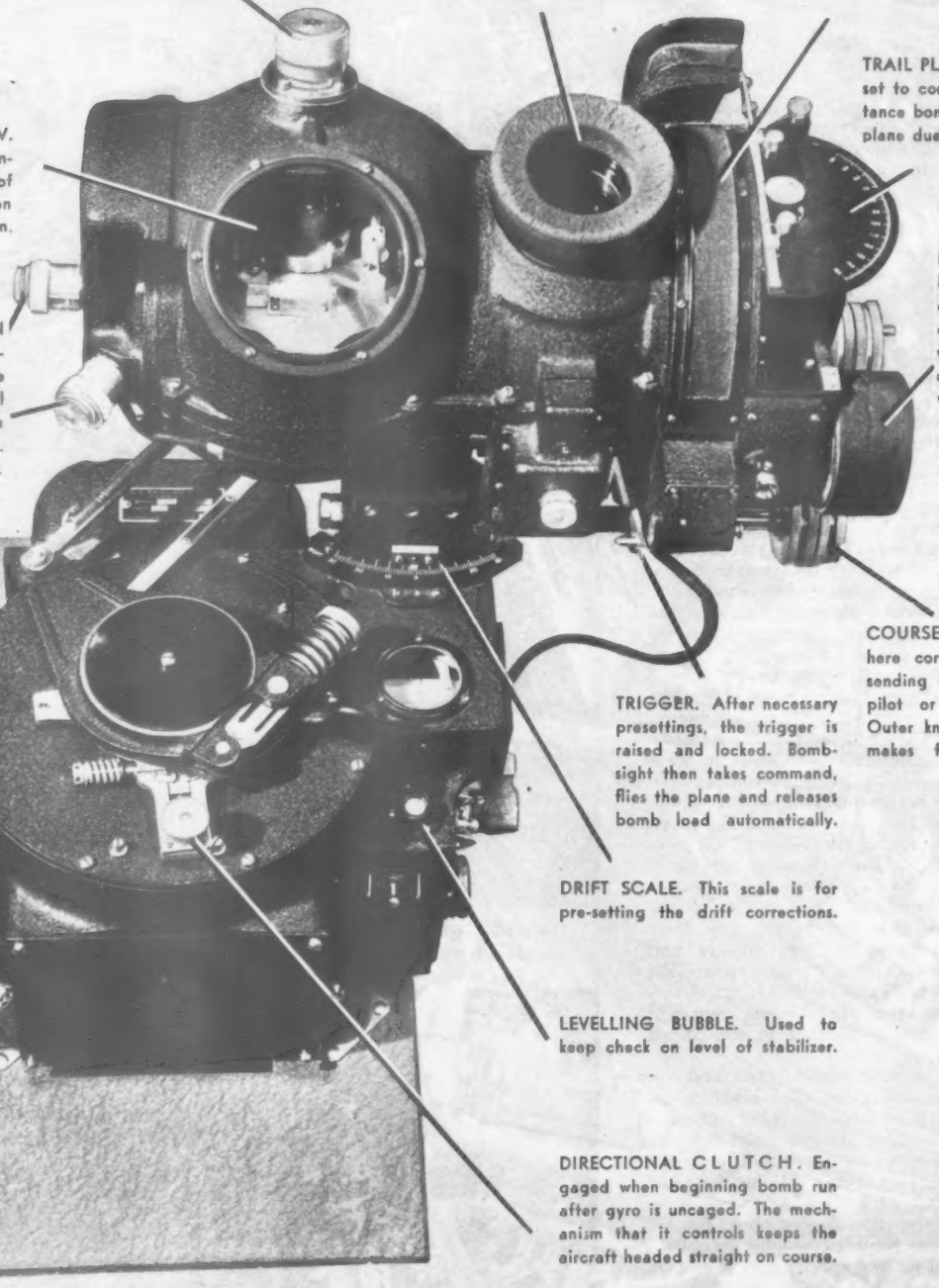
Memorial services aboard a CVE. Pilots on the escort carriers fly more hours than those aboard the bigger carriers, they support landings—and they suffer casualties.

The BOMBSIGHT

CAGING KNOB. Gyro is locked or "caged" until plane is turned to put initial point and aiming point in line. Bombardier then uncages the gyro and engages the directional clutch to hold the plane on its course.

TELESCOPE EYEPIECE. Bombardier sights on target through this rubber eyepiece while telescope mirror is driven electrically to follow the target.

INDICATOR WINDOW. Beneath this cover are the rate index and the power-driven telescope index, indicating speed of drive of mirror in telescope. The telescope index drives on the preset rate index. As they meet, bombs are automatically dropped.



TRAIL PLATE. This scale is set to correspond with distance bomb will lag behind plane due to air resistance.

GYROSCOPE WINDOW. Bubble levels inside the window indicate precession of either gyro. The precession knobs correct condition.

DISC SPEED KNOBS. Covered dials preset the calculated speed with which bombs of a given weight will fall to target.

GYRO PRECESSION KNOBS. If violent maneuvers are engaged in while gyro is uncaged, it will "precess," that is, begin spinning off its vertical axis. Knobs correct precessing.

COURSE KNOB. Two knobs here correct for drift by sending electric signals to pilot or automatic pilot. Outer knob on same shaft makes finer adjustments.

TRIGGER. After necessary presettings, the trigger is raised and locked. Bombsight then takes command, flies the plane and releases bomb load automatically.

DRIFT SCALE. This scale is for pre-setting the drift corrections.

LEVELLING BUBBLE. Used to keep check on level of stabilizer.

DIRECTIONAL CLUTCH. Engaged when beginning bomb run after gyro is uncaged. The mechanism that it controls keeps the aircraft headed straight on course.

PLANE DIRECTION

Here is the first, exclusive description of how the famed Norden bombsight works.

SINCE crashed bombers have provided our enemies with the famed Norden bombsight, the armed services have made available to FLYING, for the first time, detailed photographs and descriptions of this precision instrument.

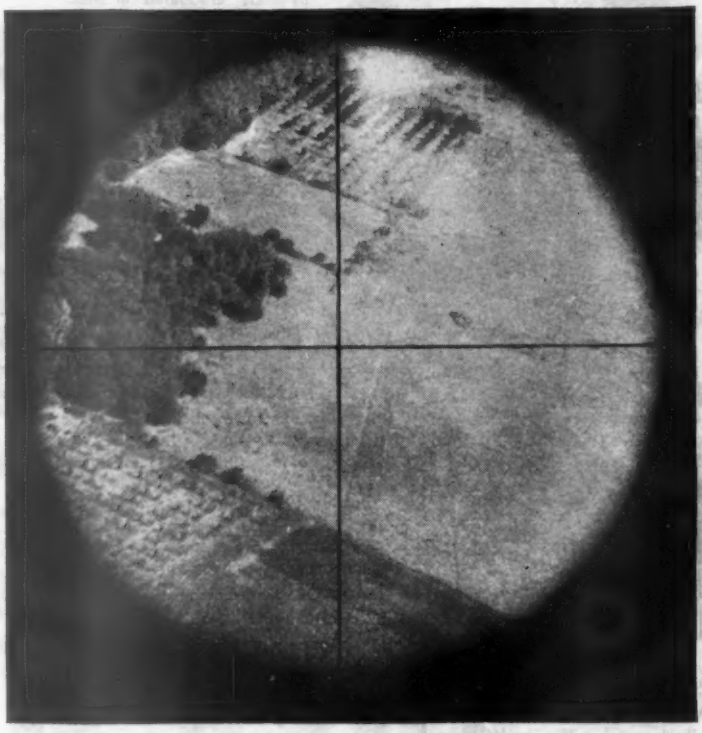
For years, the Norden was so secret it could hardly be mentioned. It was kept in air-conditioned dustproof vaults, surrounded by high barbed wire and constantly patrolled by guards. When a bombsight was taken to a plane it was always carried by two men wearing service pistols and its canvas cover was never removed until the aircraft was in flight. AAF bombardiers had to swear a solemn oath to guard it with their lives.

Early in the war when a *Catalina* sank near a coral atoll just south of Hawaii, U. S. Naval vessels were dispatched to the scene and divers searched for the plane. Grappling hooks brought it up, the bombsight was removed and destroyed, and the plane was allowed to return to the bottom.

The complete bombsight actually is two mechanisms—a lower unit or stabilizer, and an upper unit consisting of a number of assemblies, most important of which are the telescope, the computer and the gyro. The stabilizer keeps the line-of-sight direction fixed, or controlled. It also initiates a signal that tells the pilot or auto pilot how the plane is to be maneuvered to solve the bombing problem.

The stabilizer also controls the flight of the plane, through the ship's pilot or auto pilot. So well do the stabilizer and auto-pilot perform this function that, once the bombsight has been set on the bombing run, the plane would continue its flight on a perfectly even keel and drop

Sailor demonstrates how bombsight is operated. His right hand adjusts rate knobs (3), while left hand operates course knobs not visible. Figure 1 at top is caging knob and (2) is window of telescope through which he peers.



In Flying Fortress nose, the bombardier peers through the telescope of his Norden bombsight. What he sees is shown at left. Once the trigger is locked, the telescope follows the target and the auto pilot flies the plane.

its bombs at exactly the right instant in time and the right spot in space, even if every member of the crew were killed at that moment. The plane itself would continue on the predetermined course until it ran out of gas or was shot down.

The telescope is used to sight on the target. The gyroscopes hold the bombsight stable. The computer solves the various mathematical problems which confront the bombardier just prior to the bombing run.

What are some of these problems?

First is the speed of the plane through the air, which imparts exactly the same speed to the bomb at the instant of release. Second is the force of gravity. Third is the force of air resistance. Fourth is wind motion and fifth is target motion.

The force of gravity and air resistance are compensated for by a precalculated table which is given to the bombardier. From this table he gets his first setting on the bombsight—the actual time of fall from his altitude.

Since the bomb is traveling at the speed of the plane at the instant of release, but is slowed by air resistance and follows a steadily-steepening curve of descent, this data, too, must be precalculated and given to the bombardier in a table. He, in turn, must set the bombsight to make allowances for this additional correction, which is called "trail."

Then comes wind correction. Whenever wind is blowing, the bomber—and the bomb—is in a moving block of air which affects their ground speed and drift. The wind may be blowing from head-on—in which case the ground speed of the plane will be retarded. It may be blowing from behind, in which case the ground speed of the plane will be increased. Or it may be a crosswind, in which case a drift correction must be made.

Correcting for drift is especially complex since, if a plane is crabbing, the bomb does not fall on the ground track of the plane but is carried along in the moving block of air—the wind. In the Norden, this correction does not require a special setting but is made automatically by a mechanical linkage between the trail mechanism and direction control.

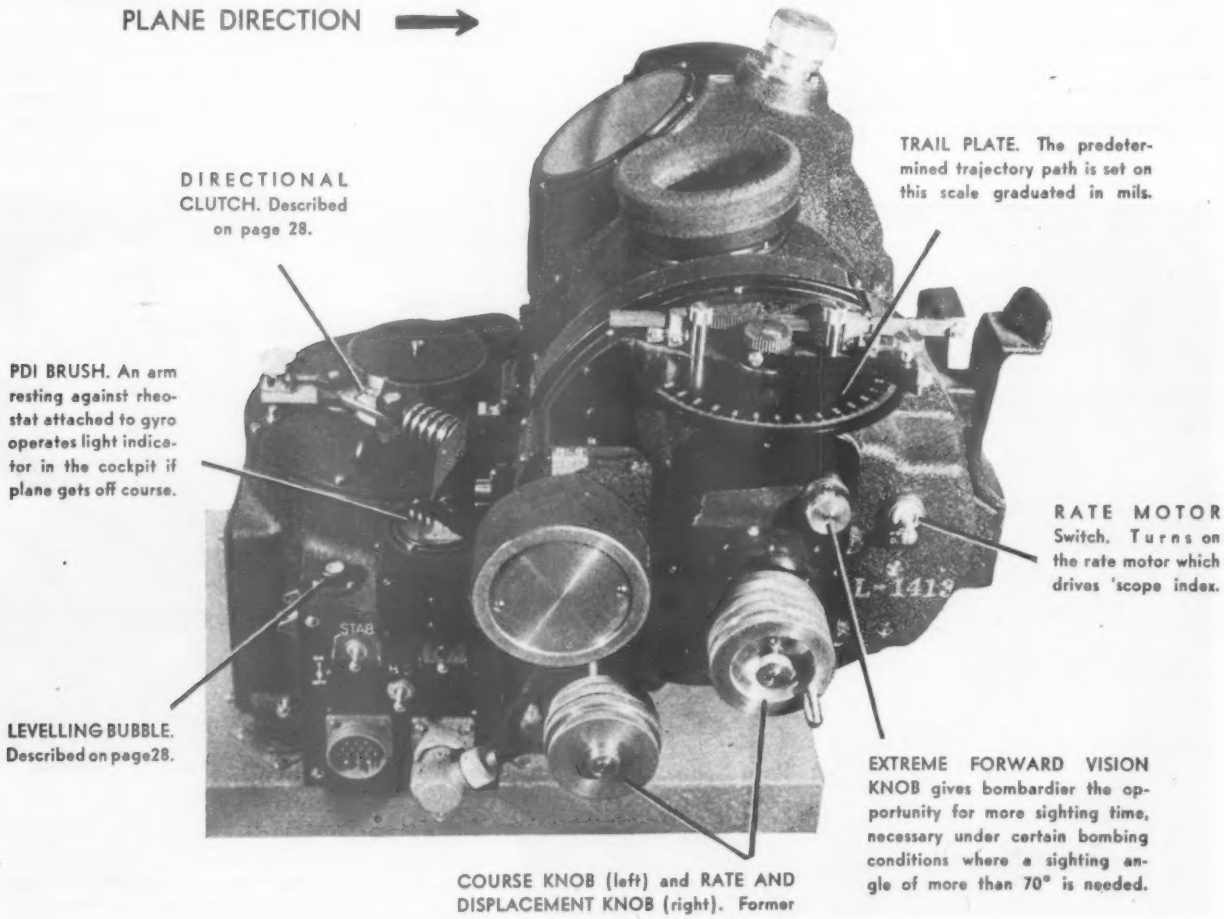
Target motion has the same effect as a wind of the same velocity in the opposite direction. In practice it doesn't make any difference whether the wind or the target is in motion, nor does a combination of wind and target motion require any new setting. After the settings for trail (or lag) and time of fall are made, the bombsight is concerned only with the resultant "closing" speed and direction of the airplane with respect to the target. It need not be concerned with the causes of the relative motion.

These corrections have solved the basic problem of bombsight accuracy. But there is still a new problem—the fact that the airplane itself is not stable but rotates about three axes and can also move forward, side to side and up and down. In the Norden bombsight, electrically-driven gyros—one with a vertical and the other with a horizontal axis—control the stabilized line of sight.

Now how does the bombsight operate? The problem is comparatively simple in essence, if not in detail. As the bomb is released, its speed (inertia) moves it forward, gravity pulls it down, and air resistance retards both actions. The problem is to determine the correct point to release the bomb.

The first calculation is the length of time required for the bomb to fall to the target. The bombsight then determines the horizontal speed with respect to the target and multiplies that speed by the time of the fall. Result is the distance which the bomb would travel horizontally (with no retardation) during that

(*Continued on page* 124)


PLANE DIRECTION
DIRECTIONAL CLUTCH. Described on page 28.
TRAIL PLATE. The predetermined trajectory path is set on this scale graduated in mils.
PDI BRUSH. An arm resting against rheostat attached to gyro operates light indicator in the cockpit if plane gets off course.
RATE MOTOR Switch. Turns on the rate motor which drives 'scope index.
LEVELLING BUBBLE. Described on page28.
EXTREME FORWARD VISION KNOB gives bombardier the opportunity for more sighting time, necessary under certain bombing conditions where a sighting angle of more than 70° is needed.
COURSE KNOB (left) and RATE AND DISPLACEMENT KNOB (right). Former is described on page 28. The latter provides adjustment for ground speed, or the apparent motion of the terrain below.

A TAX PLAN FOR AVIATION

By ARCHIE B. GOODMAN

End aviation taxation by the states in favor of Federal controls, recommends tax economist.

The author, a Ph.D., is a licensed pilot, aircraft owner, licensed CAA instructor in meteorology, public finance specialist, and contributor to the Airlines Tax Study, Civil Aeronautics Board. Although on active duty as aerology officer for the U. S. Navy, the Navy Department is not responsible for the opinions expressed in this article.

WITH aviation on the eve of an enormous post-war expansion, private and commercial flying interests should study carefully today's hodge-podge of aviation taxation and try to develop an orderly tax system.

As a former member of the staff of the Committee on Intergovernmental Tax Relations—the committee that recently prepared a lengthy report for the U. S. Treasury and Congress—I have studied the aviation tax problem closely and find remarkable parallels between aviation and motor vehicle taxation. On a basis of these parallels I propose the following aviation tax plan:

1. That *personal property taxes* on aviation be made exclusively by local and state governments.

2. That a graduated system of *registration fees* for aircraft be developed solely by the Federal Government.

3. That aviation *fuel taxes* be levied solely by the Federal Government.

4. That all special Federal, state and local taxes and fees collected from aviation be spent exclusively to improve aviation facilities.

5. As an incentive to the states to get out of aviation registration fee and aviation fuel taxation, the Federal Government might offer to repeal its taxes on automobiles and automotive fuels, leaving these taxes exclusively to the states.

Taxes on domestic air carriers alone increased from less than $3,000,000 in 1939 to more than $18,000,000 in 1943. Most of this was collected by the Federal Government—only 9.4 per cent by the states in 1943—but if anyone doubts that state taxation has potentially great sources of income and nuisance value, he need only contemplate the fact that most states could, but do not yet, levy extensive aviation gasoline taxes, and that most states could, though they do not yet, tax airline planes and equipment which are already taxed by other states.

There must be a strong trend toward Federal tax controls in aviation. Already the battle is engaged against multiple taxation—the imposition of overlapping taxes by the same jurisdiction, or the imposition of the same taxes by different taxing jurisdictions.

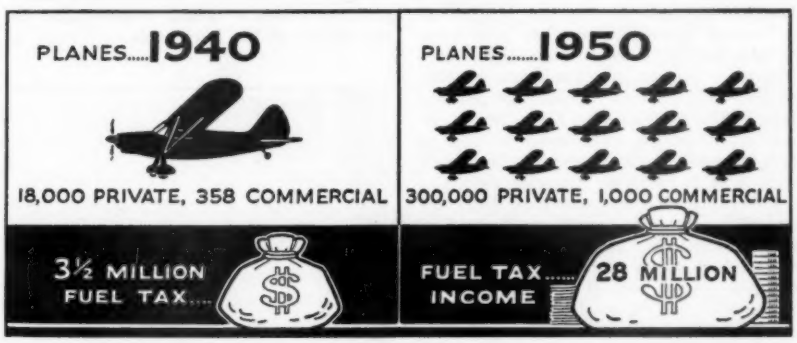
In the Northwest Airlines case which came before the Supreme Court early last year, it became apparent that the State of Minnesota had taxed the entire Northwest Airlines fleet to its full value notwithstanding the fact that six of the seven other states through which the airline operated had also taxed a portion of the same fleet. Concurring justices suggested that the whole problem of multiple taxation should receive the attention of the Congress. The Civil Aeronautics Board will soon submit a lengthy report on aviation taxation to the Congress—apparently as a result of a Congressional request encouraged by the Supreme Court. Whatever course such consideration may follow, it is certain that there is little in aviation's historical background on which to establish an equitable tax program.

A close parallel to the problem and its solution, however, may be drawn from study of American experience in highway user taxation.

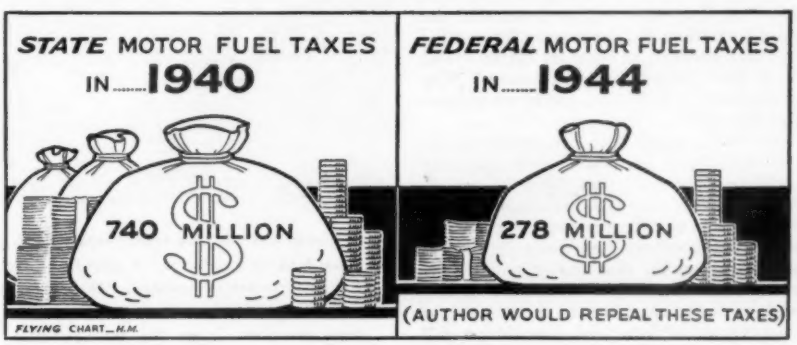
Analysis of the development of special motor vehicle taxation indicates its subjection to three major taxes: (1) personal property, (2) registration, and (3) fuel. Minor additional sums are collected from other taxes levied on commercial highway transportation organizations but they are of little fiscal significance.

Our first motor vehicles were subject only to personal property taxation, in the same manner as wagons, livestock, house-

(*Continued on page* 120)



If aviation gasoline were universally taxed four cents per gallon, it would produce the income estimated in chart above. Even assuming 300,000 private planes by 1950, the tax income would be only about 3.8 per cent of state motor fuel tax collections in 1940. In return for the states repealing their aviation fuel taxes, the author suggests that the U. S. might repeal its tax on all gasoline—currently 10 times future aviation gas tax estimates.



Let's Simplify Navigation

By G. SIDNEY STANTON

Pilots would no longer need to correct for variation if magnetic meridians replace the isogonic lines on charts.

U.S. COAST & GEODETIC SURVEY
MAGNETIC STATION
WASHINGTON, D.C.
FOR INFORMATION WRITE TO SUPERINTENDENT, WASHINGTON, D.C.
$250 FINE OR IMPRISONMENT FOR DISTURBING THIS MARK

U. S. magnetic station marker.

"SHIPS have been piled on rocks and planes have crashed into the sides of mountains or have been completely lost because of misapplication of magnetic variation. There is no other single item in the whole field of navigation as important as the proper application of this factor." The above quotation, taken from the official CAA text on air navigation (Bulletin No. 24) is familiar to tens of thousands of pilots who have earned their private or commercial certificates. In fact, the CAA has considered it so important that a large percentage of the questions on the pilots' written examinations have been framed to test the applicant's mastery of the proper technique in handling variation data.

Ingenious rhymes, nonsense syllables and silly sentences have been devised as aids to memory. According to a Navy textbook on aerial navigation, "One of the favorite 'rules' with the midshipmen at Annapolis" is "Can Dead Men Vote Twice?" The first letter indicates the sequence by which one goes from a compass course to true course, viz., compass course +/− deviation = magnetic course +/− variation = true course. In other widely used texts the student is urged to memorize the jingle: "Variation east, magnetic least; variation west, magnetic best." Still another text suggests that the pilot's troubles will be greatly lessened if he will constantly bear in mind: "Tell Vera Mike Didn't Call Wednesday" [The reverse of the first rule, adding consideration for wind].

It now appears that practically all of the difficulties associated with applying correction for variation (also known as "declination") can be eliminated by a modification of the aeronautical charts. No more need students lie awake nights trying to remember that under certain circumstances westerly variation is added and easterly variation is subtracted or vice versa. Pilots and navigators will have no further occasion to trace the curlicues and whirls of dotted red lines wandering erratically across the charts and they may navigate with precision without ever being aware of such technical terms as "isogonic" and "agonic." Even more important is the increased safety which will result for both pilots and passengers by making it far less likely for a pilot to make a wrong computation in this phase of his navigating.

The proposal, in brief, is to change the design of aeronautical charts by eliminating the present isogonic lines and substituting therefor a set of magnetic meridians. Isogonic lines shown on charts as red dashed lines are constructed in much the same way as isobars on weather maps, which are drawn to connect points of equal atmospheric pressure; or isotherms, which connect points of equal temperature. The word "isogonic" is a combina-

The isogonic lines, here overprinted on a chart of the U. S., are drawn to connect points of equal magnetic variation. A pilot flying within the area bounded by these lines makes the compass correction indicated. The author proposes to substitute for these isogonic lines, magnetic meridians such as are shown on the map at right. By plotting his course along these meridians (page 34), the correction for magnetic variation would be eliminated.

FLYING, JULY 1945

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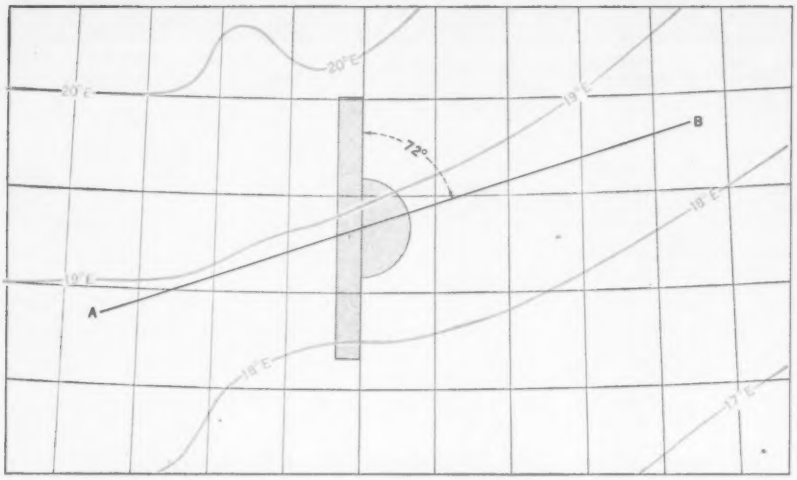
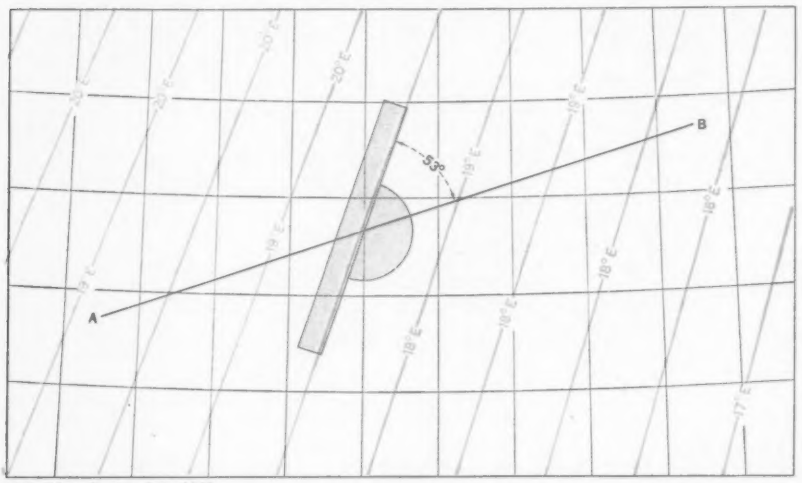


Contrast conventional method of plotting course, above, which involves calculating magnetic variation, with plotting along magnetic meridian, below, which gives true magnetic course.



© G. Sidney Stanton, July, 1945.

tion of two Greek forms—"iso," meaning equal and "gon," meaning angle. Hence, "isogonic" means "equal angles," or equal variation. The word "agonic," applied to lines connecting points at which there is no variation between true north and magnetic north, is derived from the Greek "a," a negative form, plus "gon." Hence, the agonic line is one representing no variation.

As every pilot knows, the reading obtained from measuring the course line drawn on the chart is not the reading he will use to steer by while in flight. After measuring his true course on the chart he must obtain a compass direction by converting the angle measured from true north into an angle measured from magnetic north. This involves a "correction" (the Navy calls it "uncorrecting") for magnetic variation. Selecting the isogonic line nearest his point of measurement, the pilot observes the value given and adds this value if labeled W (westerly) or subtracts if labeled E (easterly).

Conversely, if the pilot in flight wishes to compute the true course he is flying, he will use the magnetic course shown by his compass and obtain "correction" by applying the value indicated on the isogonic line. In this case, however, he will reverse the previous procedure and will subtract westerly variation, or add easterly variation.

These conversions are subject to a number of errors.

1. Frequently there are additional computations to make (for deviation and wind correction) and the pilot may forget to apply the variation. Under such circumstances his course could be as much as 24° in error in the United States (and much more in regions to the north).

2. Because the easterly or westerly variation is sometimes added and sometimes subtracted, the pilot may apply the variation incorrectly, with a possible error of as much as 48°.

3. He may mentally transpose the figures, for example, using 21 instead of 12.

4. He may misread the value indicated by the isogonic line.

5. Inasmuch as the computation is usually performed mentally, he may add or subtract incorrectly.

Variation should not be confused with deviation. Variation is the magnetic influence exerted on the compass by sources outside the airplane, whereas deviation is compass error caused by magnetic fields within the airplane itself. This proposed new method of navigation will not eliminate computation for deviation.

At left is illustrated the present method, which involves making the measurement and then adding or subtracting our isogonic value.

Lower chart illustrates the simplicity of the proposed new method, which consists of the measurement only.

The only purpose of the isogonic line is to provide the pilot with a value whereby he may convert from "true" to "magnetic," or vice-versa. If magnetic meridians were printed on the chart instead of isogonic lines, all five of the above sources of error would be completely eliminated. Instead of indulging in mental gymnastics and following the devious meanderings of isogonic lines, the pilot would obtain his magnetic course with the same ease and simplicity he now enjoys in measuring his true course on the aeronautical chart. Instead of learning a complicated and sometimes confusing set of rules, involving the memorization of rhymes and jingles, the pilot would need to understand only one simple statement: "Measure magnetic course from the magnetic meridian."

Although this simple explanation is all that is necessary for the pilot to know in order to use the magnetic meridians for practical navigation, the principle upon which the meridians are constructed involves a thorough understanding of geomagnetism. Many people have a vague and inaccurate concept of the cause and nature of geomagnetism, and even scientists who have given a life-time of study to the subject readily admit that there are many characteristics which baffle them. In one respect geomagnetism is even more mysterious than the phenomenon of electricity. Although no one knows exactly what electricity is, we do know how to generate it and how to use it; and more important, we know that electrical forces are dependable and always act in exactly the same way. Geomagnetism, on the other hand, cannot be generated and its effective use is subject to limitations imposed by its erratic and unpredictable behaviour.

A popular misconception is that the north-seeking end of the compass needle is attracted by a huge deposit of ore or magnetite (lodestone) located near the North pole. Only recently the Coast and Geodetic Survey received the following inquiry from a syndicated newspaper information service: "Is there a mine of iron ore which influences the needle to point north? Would it be of any value to use commercially? Where is it located?" Such a concept of the cause of the earth's magnetism is entirely erroneous.

Another common belief is that the earth has "magnetic poles" similar to those of a bar magnet. This concept, although more plausible, also appears to be inaccurate for two reasons: the relative intensity of the magnetic field as measured at the earth's "poles" is not sufficiently great to satisfy such a theory; and the angle of magnetic dip (or vertical

(*Continued on page* 116)

Here's How TO RUN AN AIRPORT

On hand to greet each incoming plane, Owens Field linesman hand-signals Businessman C. W. Taylor, State College, Pa., to the gas pits.

The customer is king at this airport—a fact which virtually guarantees success.

ONLY a tiny handful of private airports throughout the United States meet the customer-service qualifications of the Hawthorne Flying Service field, shown on this and the following pages. The vast majority of airports catering to the private pilot are comparable to the four featured in "How *Not* to Run an Airport" in FLYING's June issue. Incidentally, one of those four airports had a $25,000 fire even as the June issue was coming off the presses.

To locate a "good" airport, FLYING asked a number of private pilots, who do a substantial amount of cross-country flying, for their help. The Hawthorne field at Columbia, S. C., was recommended to

(*Continued on page* 150)

Linesman checks with Taylor on service required on his Piper Super Cruiser—fuel, repairs, etc:—notes time plane is needed.

Taylor points out damaged tailwheel, requests replacement. Duplicate of linesman's list will be shop manager's repair guide.

With assistant already wiping windshield and cleaning plane, linesman directs an impressed, friendly customer to airport office.

Linesman refuels plane—with fire extinguisher nearby—as assistant vacuum-cleans its interior, a regular airport service.

Service tag attached to plane's instrument panel verifies completion of servicing and refueling.

Following linesman's repair list, mechanic signs a requisition for new tailwheel out of airport stock. The plane is moved from line and repairs are completed in .6 of an hour—which means that labor cost will come to $1.50.

Routine servicing is completed in 20 minutes. Whether it requires repairs or not, plane is moved to parking line, tied down, chocked.

Taylor meets Walter Phipps, airport manager, finds him ready to give expert advice concerning remaining leg of his business trip.

Directed to airport's neat washroom—which includes shower facilities—Taylor freshens up for business contacts he is to make while in Columbia.

Taylor finds the comfortable airport lounge available for his conference with T. D. Blair, businessman-pilot of Winston Salem, N. C.

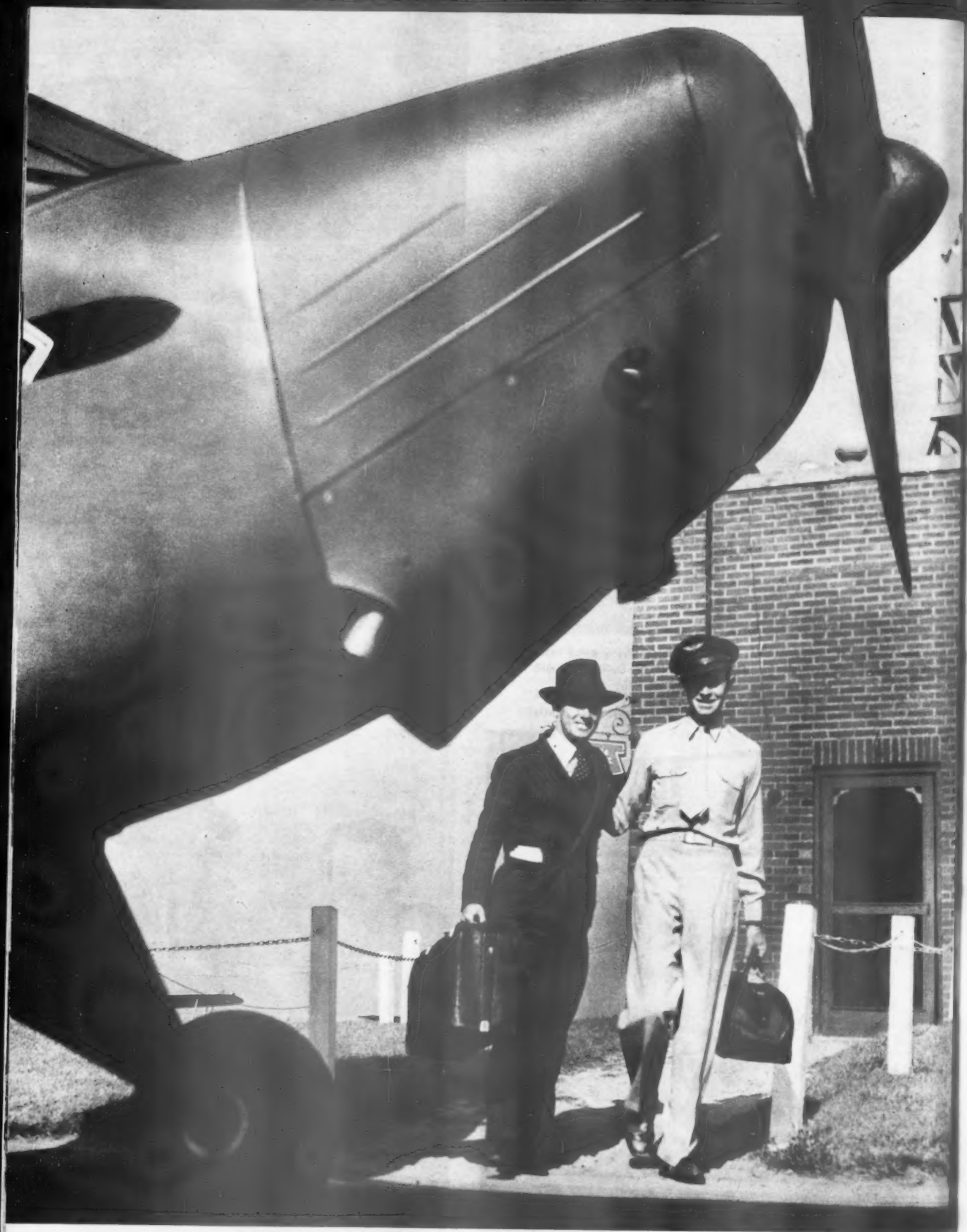
Manager Phipps offers Taylor one of the airport's cars, enabling him to speedily complete business engagements he has made in the city.

At the Skyshop, airport's modern lunchroom, he enjoys a quick snack with Instructress Betty Morton (left) and Receptionist Daisy McCaskill.

Carefully displayed equipment in office showcases attracts Taylor's attention, prompts purchase of new navigation lights for his plane.

Back at airport, Taylor plots flight to Atlanta, aided by C. F. Rinehardt, airport flight director. Ready room is equipped with desk, maps, charts.

Four hours after arrival, Taylor is ready for next leg of trip. Time he has saved more than compensates for nominal service bill.



A satisfied customer whose schedule has been met to the minute, Taylor gets a cheery send-off from Flight Director Rinehardt as they stroll down to flight line where his repaired and serviced plane awaits, its engine already warmed up for the Atlanta hop.

By FRED HAMLIN

DISCOUNT the fact that Bennett Champ Clark, ex-senator from Missouri and a chosen-instrument advocate, was among the first to call on President Truman at the White House. It may be remembered that Mr. Clark not long ago sold the chosen-instrument idea to Bernard Baruch so thoroughly that Mr. Baruch took the case to the White House himself. More recently Mr. Clark has been serving as legal counsel for a number of pro-instrument labor unions that have testified on the Hill. But there was probably more truth than significance in his statement after visiting President Truman that his was one of the few calls that was purely friendly.

More significant was the visit of Welch Pogue, chairman of the Civil Aeronautics Board, and on the record as an opponent of the chosen instrument. Pogue was also prominently on the liberal side at the Chicago conference on aviation. After his White House visit, Mr. Pogue described it as "very nice," but parried other questions with a smile. Consensus is that Mr. Truman will follow Pogue's lead in the international field and keep it open for competition. He may also be expected to help any legislative tangles which may arise on the Hill.

Perhaps better-informed on aviation matters than was President Roosevelt, President Truman has many friends in the industry, as indicated by the little-known fact that airline leadership backed him in Missouri during the 1940 campaign and he may be expected to take an active interest in aviation's problems, especially when it comes to reconversion.

Machine Tools

Final show-down in the sale of Government-owned machine tools will probably not come until more facts are available, despite recent reports to the contrary and current agreement of all concerned on how the problem will be solved. Edward H. Heller of the Surplus Property Board testified the other day before the Senate Small Business Committee that contractors in possession of Government-owned machine tools should have first chance to buy the tools in their plants. Heller added that the policy was tentative but would permit contractors to perfect post-war production plans and eliminate delays and employment interruption.

The Senate Committee agreed, but with reservations. How many machine tools would the Government unload? Brig. Gen. D. N. Hauseman, in charge of Army Service Forces readjustment, estimated that more than 12,000 standard general purpose tools were on their way to market early in the summer, in addition to some 3,000 special-purpose tools. These could be liquidated within two months, with 4,400 general-purpose and 600 special-purpose tools released monthly thereafter for four months.

After victory over Japan, he predicted, tools will be declared surplus faster than they can be disposed of. The Senate Small Business Committee is inclined to go along on this on the grounds that subcontractors as well as contractors will benefit. But they favored holding up final action until a complete survey of the machine tool supply, Federal or privately owned, had been made. This should take most of the summer, it was estimated.

Thunderbolt Blitz

The P-47N, another plane now making history in the Pacific was, we learned the other day, a history-making job from the beginning. The way we get it, Hart Miller and Fred Marchev of Republic were told in Washington in the fall of 1944 that the AAF was going to cut back *Thunderbolt* production. The war would be shifted one day to the Pacific and *Thunderbolts* lacked the necessary operating range—at least 1,000 miles out and 1,000 back, with enough capacity left over to carry bomb loads and strafe the target.

Miller and Marchev bluffed at this point—said they could produce such a job and, what's more, could do it in 60 days. They were bowed out of AAF headquarters with permission to make the try despite brass-hat skepticism. Fifty-eight days later their P-47N flew 2,000 miles from Farmingdale to Eglin Field and back without refueling. Thus did the 20,000-pound fighter that can fly higher and farther than any other now in the public records go into mass production.

The P-47N has the first automatic flight instruments to be installed in a fighter. Nor were the designers content to rest with the AAF specs for a 2,000-mile range. They upped it. Incidentally, there's nothing to the rumor that P-47N's are being modified for use on carriers. The story probably got started when a carrier load of *Thunderbolts* (probably D's) took off from carriers for the first time to fly into Saipan. But they didn't return to the carrier, not being equipped with arresting gear hooks.

Jap Nemesis

Japs may look forward without high anticipation to increased numbers of Douglas *Invaders* in the Pacific area. . . . Handicapped to a degree by heavy flak installations on the continent, the A-26's were, nevertheless, a deadly weapon against the Germans. Against the Jap, who is already weak on flak defenses, they should be devastating. The plane has terrific firepower forward (eight .50-cal. machine guns or a 75-mm. cannon) which, when at maximum, can silence almost any enemy gun installation in its path. It can also control moderate ack-ack opposition until parafrags, skip bombs, or torpedoes can be laid into the target. Rockets also have been added to the plane's armament. . . . Another asset that should pay dividends in the Pacific is the *Invader's* superior speed, plus maneuverability and a high rate of climb. During a strafing-skip-bombing run, it can operate in the 300-m.p.h. bracket, and on the break-away from the target a much greater speed can be maintained. Below 5,000 feet it will run away from most fighters. . . . As if this were not enough discouraging news for the Nips in one dose, AAF further indicates that many of the planes will be flown by experienced bomber-fighter pilots from the European theater, who are being shifted from *Mitchells*. Redeployment training has been centered at the Army air base at Columbia, S. C. In-training groups are centered at Florence, S. C., and Marianna, Fla.

Veteran Pilots

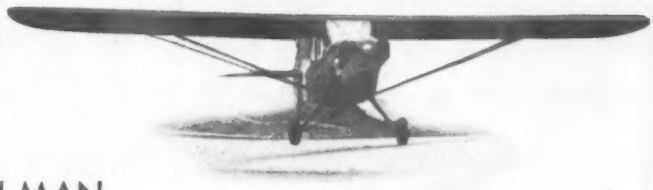
By the time this gets into print, more than 40,000 military pilots still in service will have obtained pilot certificates from CAA flight inspectors who have been visiting military air installations since last November to give exams to anybody interested. CAA had anticipated some interest and arranged for inspectors to do the job now to avoid a post-war rush; but they were surprised at the enthusiasm with which pilots greeted the service. A few of the boys put in for private certificates—said they had no post-war business flying plans.

The great majority took tests for commercials and there is much talk among

(*Continued on page* 107)

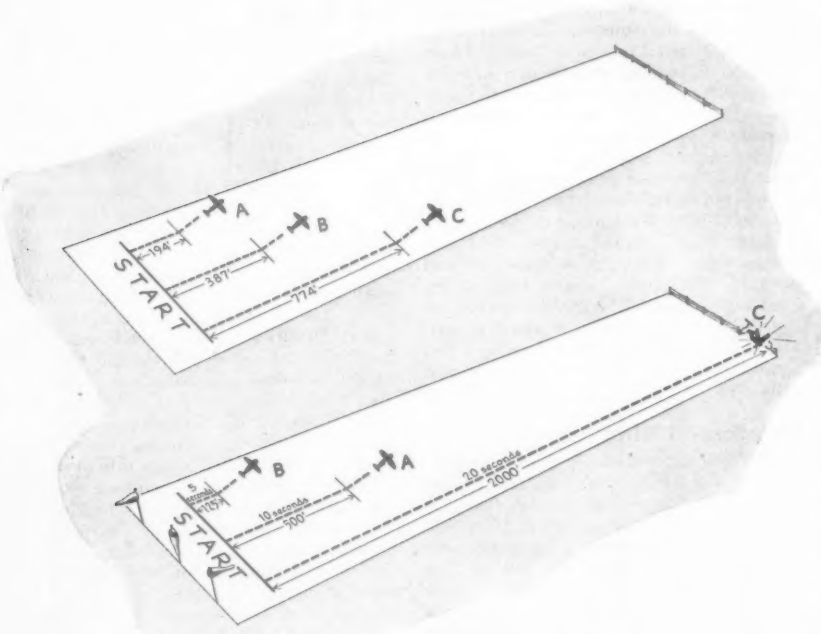
CAN I TAKE OFF?

Every pilot must know the elemental facts in this article. Many an accident might have been avoided through this knowledge.



By RAYMOND STADELMAN

Licensed pilot and associate agronomist, U. S. Dept. of Agriculture



How head and tail winds affect a plane during take-off. In upper figure, Plane A has an acceleration of 20 feet per second per second and Plane B 10 ft./sec./sec. Plane C accelerates at 5 ft./sec./sec. Note that length of take-off run is directly proportional to the decrease in acceleration. In lower figure, all three planes have the same acceleration of 10 ft./sec./sec., but Plane A took off without wind. Plane B took off in a head wind, which halved the normal take-off time, and Plane C took off with a tail wind (double normal take-off time). Given equal acceleration, the length of take-off run is proportional to square of the time. A run four times longer in time is 16 times longer in distance.

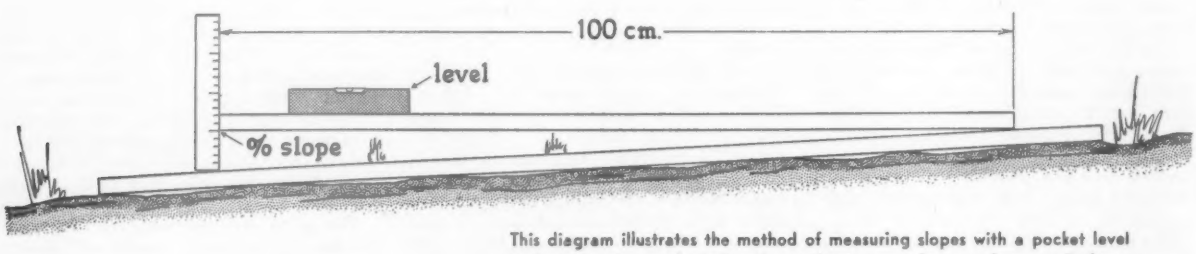
FEW pilots know just how much their take-off can be affected by wind, ground slope or take-off surface. This is vital information when it is a matter of clearing that fence or sinking your teeth into the instrument panel.

Suppose you have landed in a strange field and are wondering if you can fly the plane out again. Maybe it is a cow pasture, not very big in any direction, partially surrounded by obstructions and with a surface that leaves much to be desired. Perhaps the ground slope is pretty steep and covered with rather tall grass. Possibly the wind has changed in the meantime. Can you fly the plane out? How can you know which is the best direction for take-off? Which will help you most, the slope or the wind?

Here is a mathematical formula which will give you a pretty good answer—at any rate, much better than an offhand guess. You should memorize it or paste it in a leaf of your logbook. In order to use it, you must first find out one bit of information regarding the performance of your plane—one we shall call its "normal acceleration."

We shall define acceleration as the *rate of increase in speed*. For instance, your plane starts from rest on a windless airport and, with throttle wide open, reaches take-off speed of 60 m.p.h. exactly 10 seconds after it began to move forward. Assuming that the plane has uniformly increased its speed during those 10 seconds, you will see that for each second of time it gained six m.p.h. in speed. Thus, under the test conditions, the "normal acceleration" of the plane was six m.p.h. per second.

(*Continued on page* 128)



This diagram illustrates the method of measuring slopes with a pocket level and centimeter-graduated. A centimeter equals one degree of slope.

—CAN I LAND?

Landing the conventional airplane on an airport with safety and efficiency is a technique that can readily be mastered.

By DON DWIGGINS

Flight instructor, Falcon Field, Ariz.

FOR years fledgling pilots have been told dozens of tricks to help them through that touchiest of all flight maneuvers—the landing. Many of them work, some are helpful, some detrimental, and others simply old pilots' tales. All stress one fundamental requisite: if you break your glide in the *right* place with the *right* amount of elevator pressure, your chances are better than even of making a pretty good landing. Just how to find this "right place" is where the authorities disagree.

The CAA believes that there is some mysterious "sixth sense" of height judgment possessed by some student pilots that is lacking in others. "Estimation of altitude and gliding distance," says their Bulletin No. 5, "is a matter of accurate estimation and association of the factors affecting them. The ability to develop proficiency in correlating these is more of a personal attribute of the student, dependent upon his powers of observation and ability to make practical use of such observations . . ."

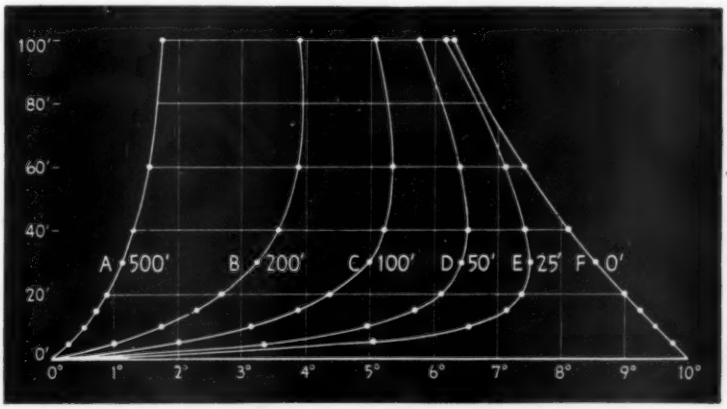
To dismiss altitude estimation as a purely "personal attribute" is an admission that a standardized procedure in instructing this vital point is lacking. A more logical approach to the subject is used throughout the British Empire Flying Training Schools, where the attitude is that "the analysis of the problem is more difficult than the solution." The British have these pertinent words to say.

"The point at which the descent is checked makes all the difference to the subsequent landing. Much research has been done with a view to finding out how an experienced pilot judges this point and whether his methods can be absorbed by a pupil. The problem is complicated because the 'point' clearly depends on the wind strength, how much throttle is open, the type of aircraft, etc."

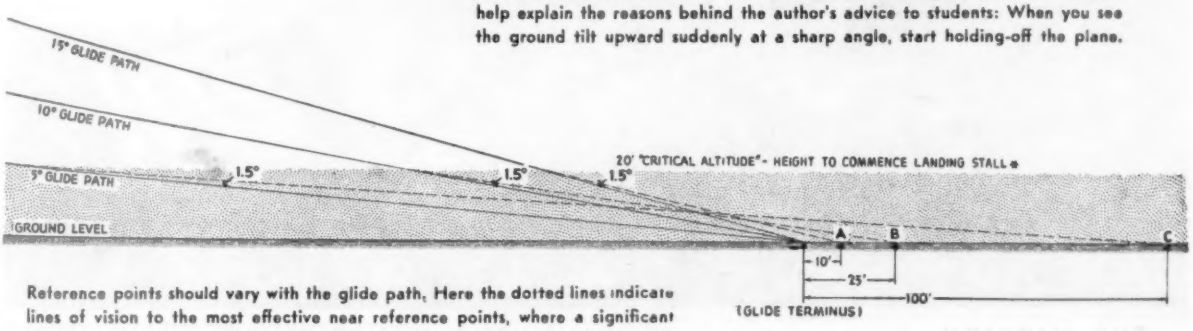
Of course every flyer knows that when the ground starts coming up at him rapidly it is time to do something about it, and he'll try to judge the distance of the ground ahead. Then when the ground seems suddenly to expand, there are other decisions he must make. Instructors say this happens at what seems like 20 feet off the ground (actually it's closer to 50) and they may give some simple method of determining just the right instant for the novice to begin landing procedures—if they are good instructors.

One rule-of-thumb method used suc-

(*Continued on page* 132)



This graph is designed to illustrate the change in perspective at various altitudes below 100 feet, while descending along a 10° glide path. The curves illustrate the angular spread between two reference points, one 1,000 feet distant and the other the distance indicated from the terminus of the glide path. The curves help explain the reasons behind the author's advice to students: When you see the ground tilt upward suddenly at a sharp angle, start holding-off the plane.



Reference points should vary with the glide path. Here the dotted lines indicate lines of vision to the most effective near reference points, where a significant change in perspective will be most noticeable from a 20-foot altitude on glide paths of 5°, 10° and 15°. Note that each point is 1.5° above the glide terminus.

MISSION X

By
Capt. MATTHEW HUTTNER

What was the organization behind big missions against Germany that contained a billion dollars worth of bombers in a column 400 miles long?

THE GENERAL Lieut. Gen. James Doolittle, with model of Me-163, commanded 8th Air Force operations.

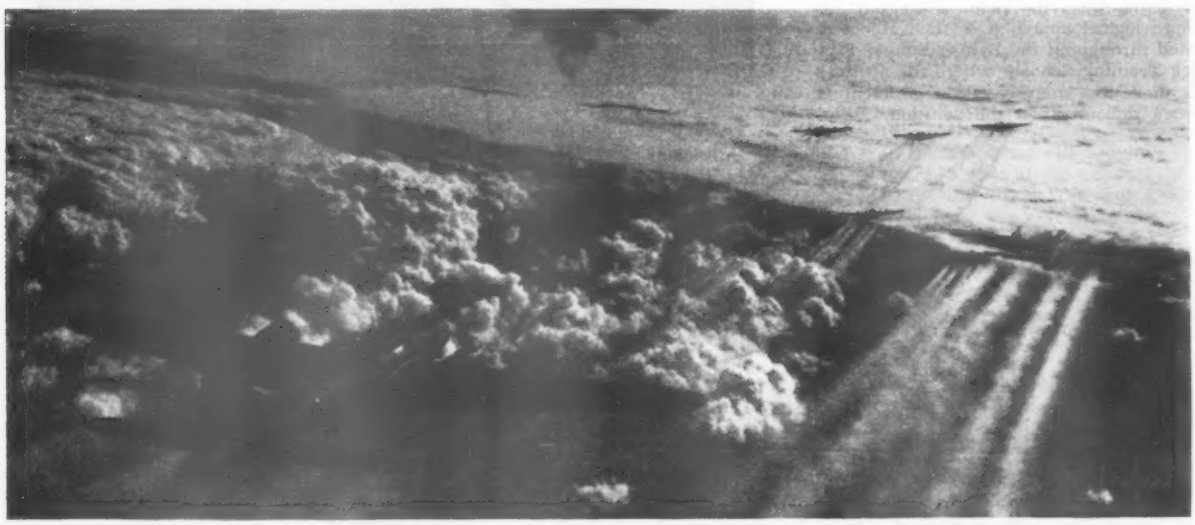
IT WAS the day before Christmas, 1944. Around the long polished table in the War Room of 8th Air Force Headquarters sat Lieut. Gen. James H. Doolittle and his staff. Outside was the coldest day Eastern England had known in 54 years. Inside, one of the hottest raids yet launched on Fortress Europe was in the making. Colonel Jones, the target chief, pointed to the navigational overlay pinned onto the wall-map of Western Europe.

"A year ago, 8th Air Force dispatched 732 bombers on its mission over Europe," he said. "Today we are sending up the record total of 2,304, supported by nearly 1,000 fighters. They will attack 11 airfields and 14 communication targets in the tactical area."

His words created a stir, but Colonel Jones concluded his briefing. Then the bomber controller announced the time of take-off, time over target, and the bomber routes. The fighter controller then described the planned operations for the *Mustangs* and *Thunderbolts*—they would sweep the target area as well as escort.

Scarcely was the briefing concluded when nearly one billion dollars worth of bombers and fighters manned by 21,000 Americans zoomed up from United Kingdom bases to deliver their lethal Yuletide surprise. The giant force left the English coast in a column 400 miles long. As the head of the column entered Germany, its last planes were just leaving England.

After crossing the Continental coast, the bombers split into three forces. *Lib-*



THE MISSION Streaming vapor trails, columns of Forts hundreds of miles long head for Germany—but only after a complex series of planning operations maintained the planes, selected the targets and briefed the airmen.

THE TARGET The bombs are dropped on the important Daimler-Benz motor transport and aircraft engine factory at Sindelfingen. Pitted fields indicate prior attacks, but this one is right on the beam, as lower picture shows.

erators of the Second Bombardment Division plastered a series of road and rail junctions and supply centers north of Trier, just opposite the bulge driven into the U. S. First Army lines by Rundstedt's panzers. First and Third Division *Fortresses* hit 11 German airfields to the north and south of Frankfurt, where photo reconnaissance had revealed as many as 50 Nazi fighters concentrated on a single airdrome. Bombing was visual.

The bombardiers proved to be in rare form. They knocked out permanent installations on several dromes and postholed a number of runways, rendering the fields temporarily unserviceable. Rail and road choke points were pounded, tracks ripped and twisted, goods-cars demolished. The flow of supplies to Rundstedt's forward elements was severely crippled.

Between Christmas and New Year's Day the 8th hammered German tactical targets in co-operation with the U. S. recuperative ground effort. Together with the Royal Air Force and the 9th they destroyed over 600 Jerries who attempted to intercept their attacks. By December 29 the back of Hitler's counter-offensive had been broken. Rundstedt was forced to extricate his badly-mauled armor.

"The story of the 8th is the story of *all* of you," said General Doolittle in a New Year's message to the members of his command. It takes but little research to show how true his words were.

To get the 8th off the ground and back home safely required the unceasing effort of some 200,000 men working 365

(*Continued on page* 110)

THE RESULT The factory is virtually destroyed. By smashing engine output, the attack met first AAF priority—to gain control of the air.

INTERNATIONAL

By ANDRE BERNIERE

Nationality markings of civil aircraft throughout the world soon will follow a standardized system.

Only country in the world using a combination of numerals and letters is the United States. The letter N is that assigned to this country. The letter C shows that that aircraft has been certificated by the Civil Aeronautics Administration. The numbers then are allocated in whatever order they are available. The letter R indicates that the aircraft holds a restricted CAA certificate; X marks the airplane as being experimental. Letters that follow the numerals are part of the serial number, have no other official significance.

WITHIN another year, the international hodge-podge of aircraft identification markings—which today finds some countries employing a combination of letters, others a series of digits and still others a combination of the two—may be a thing of the past.

World standardization of aircraft markings is on its way. The most important step in that direction was taken at the recent International Civil Aviation Conference in Chicago, where it was recommended on a world basis.

The answer will be forthcoming by September 1, 1945. The standardization proposal already has been submitted to the various nations with a request that suggestions be made to the international body by May 1, 1945. These suggestions will be correlated and then sent to the nations for formal approval by September 1.

The move comes none too soon. With the war approaching its climax, plans already are under way for vast expansion by each country of its commercial air fleets, putting international air commerce at a level undreamed of before this war. With planes of many nations roaming the skies, identification will be difficult without uniform markings.

It is conceivable that the American system may serve as the international yardstick. This system calls for a letter prefix—"N" in the case of the United States—plus another letter symbol denoting the airworthiness of the craft and then a series of numbers, ranging at present from three to five digits.

Thus, a plane with the marking NX-1733 may be identified as an American experimental type plane, the "X" being the symbol for experimental. A plane so marked may not be used for hire.

Or the number series may have an NC prefix. In this case the "C" designation means that the plane is licensed for commercial use.

Then again there might appear the prefix NR. The "R" designates a specific purpose for which the plane may be used, not including the carrying of passengers for hire. It means the plane has been adapted for such special purposes as crop-dusting, seeding, photography, research and the like.

In each instance, the "N" is the U.S. designation for purposes of international identification. It indicates that the plane is permitted to fly beyond American borders.

American aviation officials prefer the number sequence to a series of letters because digits are easier to remember than a conglomeration of letter combinations such, for example, as CF-ADHK.

The U.S. Civil Aeronautics Authority began issuing numbers in 1926 when it became obvious that it was necessary to have some means of controlling and identifying all aircraft. The answer was

PLANE MARKINGS

issuance of Government-approved numbers to all airworthy planes.

Under the American system, private and commercial planes are required to have their identification number painted on either side of the tail, on the right wing top and underneath the left wing.

CAA numbers, like automobile license numbers, are never duplicated. But, unlike automobile license numbers which usually are changed from year to year, a plane retains its number from the time it leaves the assembly line until it is definitely established that the plane has been destroyed, torn down, cannibalized, lost beyond all hope of locating it, or placed in a museum. In such instances, the numbers may be re-assigned.

But numbers on planes listed as missing for many years have not yet been reassigned. Outstanding example in that category is the NX-773 assigned to Paul Redfern's Stinson monoplane. Redfern and his craft have been the principals of perhaps the most intriguing aviation mystery of all time. No trace of either has been found since Redfern took off in 1927 for a South American flight. Annually, rumors spring up about the pilot or his plane having been located in some remote area of South America. These never have been substantiated. So long as a doubt exists, Redfern's number will not be reassigned.

Still unassigned, too, is the NR-687E which identified Paul D. Cramer's Bellanca *Pacemaker*. Pilot and plane never were heard of after the take-off on a projected transatlantic flight in 1931.

The CAA assigns numbers in blocks to its field inspectors in the nine CAA regions. The inspectors, in turn, assign them on application—usually to manufacturers. Formerly the numbers were issued direct from CAA headquarters in Washington but this practice was discontinued in 1929 when the task became much too complex for a single office to handle.

After a number is assigned, an application is submitted for registering the aircraft. The bill of sale showing transfer of the plane from manufacturer or seller to purchaser must be submitted. The craft is inspected for airworthiness and an airworthiness certificate is issued.

Serial numbers, together with such pertinent information as the type of plane, manufacturer, power plant, uses and restrictions of each plane, are on file with the CAA in Washington. In a hulking downtown Washington building one will find a small forest of dull green filing cabinets which contain the records of every aircraft—private and commercial—built, owned or flown in the United States. Yellowed folders within those filing cabinets are packed with the history and romance of American aviation.

All told, the CAA has distributed to its field inspectors 50,000 serial numbers. This does not mean that there are 50,000 civilian private and commercial planes in this country—not yet, at least. Actually, the number as of 1940—the last so-called "normal" pre-war year—was approximately 25,000. The difference is accounted for by the fact that not all of the numbers in the blocks allotted by CAA to its nine regions have been used. It is estimated that there are several thousand numbers in each block still unassigned.

The numbers are available, however, to take care of at least the first phase of the anticipated post-war aviation expansion and plans are now under study for using six digits when the post-war expansion of aviation really begins.

It was in anticipation of just such an expansion—on a world-wide basis—that representatives at the International Civil Aviation Conference began laying the groundwork for a uniform system of registration symbols throughout the world. Here are some of the principal recommendations on aircraft registration and

(*Continued on page* 96)

The system presently used by all countries other than the U. S. incorporates letters only; no numerals have been authorized. The letter or letters preceding the hyphen are those assigned to the country in which the airplane is certificated (CF for Canada, F for France, G for Great Britain, D for Germany, etc.; also see listing accompanying this article). Indications now are that the American system may be favored for world adoption, as a series of numbers is more easily remembered than a random group of letters.

By Maj. OLIVER STEWART

British Authority, Editor of Aeronautics

WHEN the forward sweep of the Anglo-American forces enabled the security stop on German rocket attacks against England to be lifted, Londoners could at least assess the effectiveness of this weapon.

Its killing power does not greatly differ from that of the bombs.

Generally in southern England (the figures would not apply to different population densities) the Germans have had to deliver about 1,000 pounds of explosives to kill one person.

Although lethal power does not differ much, V-1 and V-2 have their advantages. V-1 costs about one-fifteenth per ton delivered as much as the ordinary bomb; V-2 probably costs a lot more, but so far it would seem that there is no defense against it after it has been launched. For V-2 the Germans claimed an accuracy of plus or minus four miles. Some certainly went badly astray and thudded in open fields; otherwise the enemy figure looks about right.

V-Weapon Psychology

Londoners were divided as to which they liked less. "I prefer to hear the warning and have time to take cover" (a bank clerk). "When you hear the crash of the rocket, you *do* know you're still alive" (a charwoman). "I dislike the rumble made by the rocket when it is coming down and which follows the explosion. It sounds as if another one is coming" (a draughtsman).

Generally V-2 was considered less worrying than V-1. Your correspondent jumped when V-2's fell near his home and his office, but was slightly less frightened by V-1 bombs.

Whatever the man-in-the-street thought, British scientific workers admired the engineering that went into V-2. One told me he believed it to be the greatest piece of special research of the war.

From the moment the jet is cut by the integrating accelerometer, V-2 behaves like an ordinary shell so that ballistic calculations are valid. One trouble with V-2 was its tendency to burst in the air while rushing down from the stratosphere into the denser air at supersonic speeds.

By the way, the V-1 impulse duct engine is said over here to be the only prime mover ever invented with no rotating parts.

Earthquake Bomb

That the ordinary bomb can also develop is shown by the 22,000-pound bomb used by the Royal Air Force. Contrary to widely published statements the 22,000-pound bomb was not a development of the 12,000-pound (*Tirpitz*) bomb. Mr. Barnes Neville Wallis originally advocated the 11-tonner but had to be satisfied with the smaller bomb because at the time it was not known if there would be an aircraft able to take the larger one.

The Avro *Lancaster* is only slightly modified to take the 22,000-pound bomb. It is stripped of as much equipment as can be safely dispensed with. There are also minor under-side alterations.

High cross-sectional density and a pointed arched head are the characteristics which give the 11-ton-bomb its great penetration. Its manner of working is to blow a great chamber deep in the earth and truly undermine structures like viaducts. First used March 14 against the Bielefeld viaduct, its next use was against Arnsberg viaduct southeast of Hamm. The viaducts were breached.

From 15,000 feet the bomb will reach somewhere near the speed of sound at ground level. It would go on accelerating if dropped from greater heights.

Coupled with the name of Wallis—now given the supreme British scientific distinction of being elected a Fellow of the Royal Society—is the name of Prof. Patrick Maynard Stuart Blackett who devised the special bombsight invariably used by the RAF for aiming the large bombs.

Belief here is that the 11-ton, earthquake bomb will be valuable for certain targets in Japan. But assisted take-off or flight refuelling may be needed to provide greater war ranges in the Pacific.

Speed Claims Contest

The contest in speed claims continues. No sooner had the Ministry of Aircraft Production stated that the top speed of the Vickers-Armstrongs *Spitfire XIV* (Rolls-Royce *Griffon*) was 450 m.p.h.—the highest figure yet officially released in Britain—than the rumor began to trickle in from America that a new *Mustang* with a Packard Rolls-Royce engine was doing more than 490.

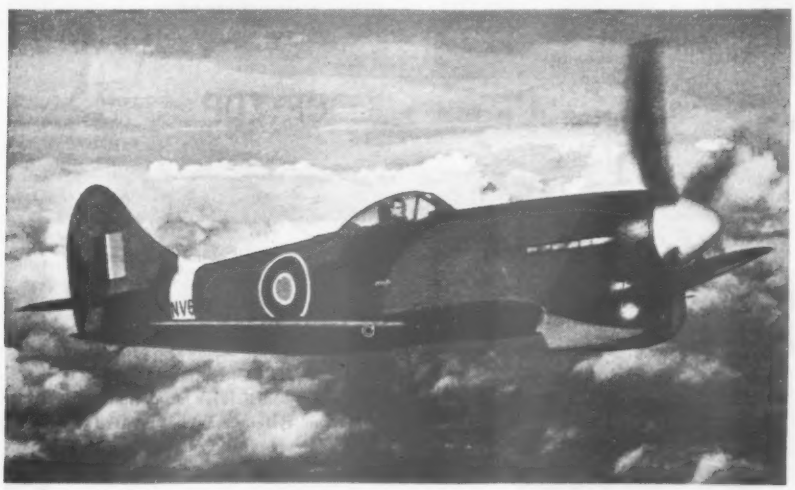
Meanwhile, *Tempest* pilots say that in practical air fighting the *Tempest* is faster than any, though the official top speed figure is only 435. The *Tempest* suffers from no compressibility troubles, the thin wings are very rigid, the controls well-balanced, the cockpit roomy and the Napier *Sabre* engine satisfactory. Operational pilots especially like the ability to see *under* the tail made possible by the bubble canopy and fuselage taper.

One strange occurrence was an outbreak of laryngitis which afflicted all pilots in a famous *Tempest* squadron. The suggestion that it was due to exhaust fumes was disproved when it still attacked pilots who used oxygen all the time. A solution to this minor medical mystery is still awaited.

Fair Fares

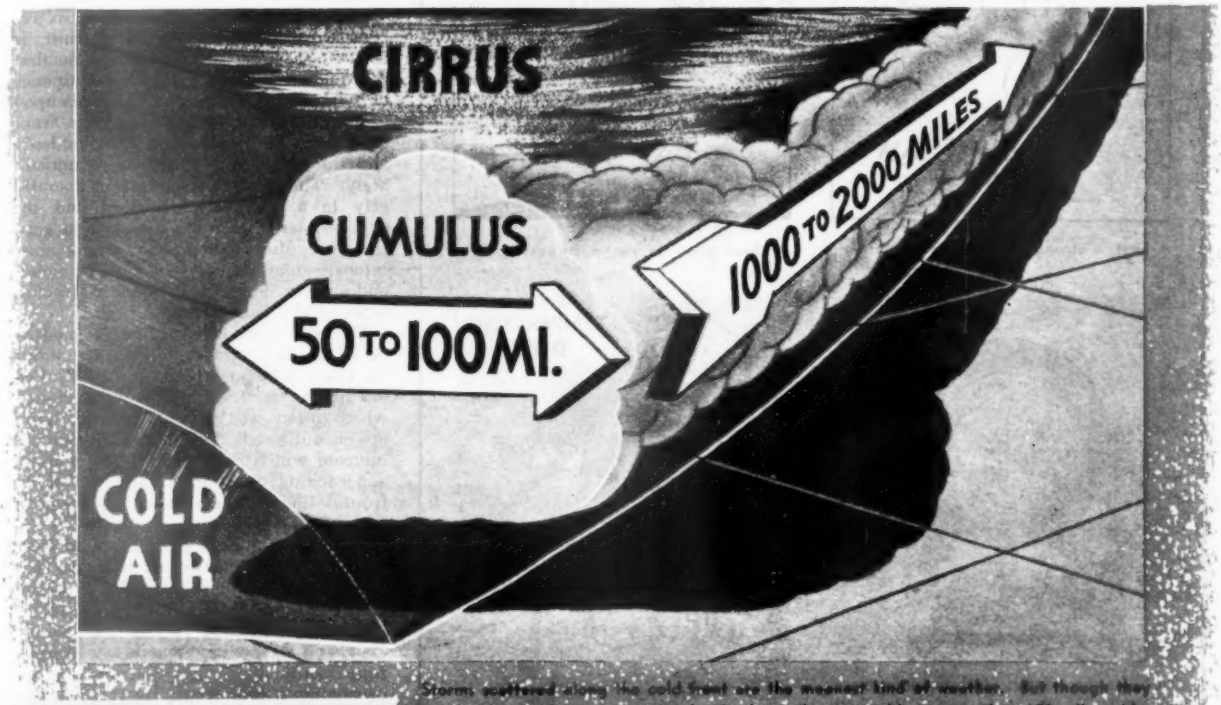
The air transport wrangle threatens to continue following discussions of Lord Swinton's White Paper proposing three monopolistic corporations to run all British airlines. One independent oper-

(*Continued on page* 146)

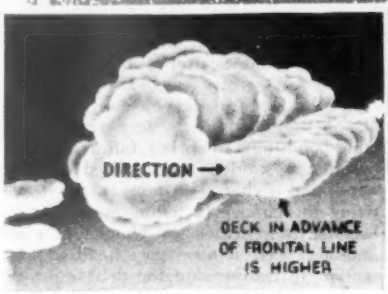


Its pilots claim this 435-m.p.h. Hawker Tempest is the fastest practical fighting plane. Its bubble canopy and tapered fuselage enable pilots to see behind and under tail assembly.

The COLD FRONT



Storms scattered along the cold front are the meanest kind of weather. But though they may be hundreds or thousands of miles long, they are seldom more than 100 miles wide.



Higher than rear clouds, pre-frontal deck indicates which side you are approaching.

Cold fronts mean ice, snow, rain, turbulence. They are whole weather factories and the only truly safe place to fly them is on the ground.

SINCE warm air rises at the equator and cold air sinks at the poles, a "polar cap"—an accumulation of a mass of cold air—builds up in the Arctic and Antarctic regions of the earth. When the pressure of this mass of air becomes sufficiently great, the *polar front*, which is the leading edge, is pushed down and [in the northern hemisphere] begins to travel south across the middle latitudes.

It doesn't move in one great forward surge. Due to the rotation of the earth, the mass of air that breaks away from the polar cap in the northern hemisphere revolves slowly with a clockwise rotation. This swirling mass of air, which covers a vast area of the earth's surface, is known as an anti-cyclone or high-pressure cell.

Its leading edge is a *cold front*. As the mass moves south from the polar region, the cold air encounters the warm air of the middle latitudes and, being heavier, pushes under it, causing the warm air to rise. As warm air is forced upward by the cold front the moisture in the warm air condenses and clouds are created. The form they assume depends upon the type of warm air being lifted by the front's movement. If it is quite moist, the cloud bases will be low while the clouds themselves will build up to great heights, developing showers or possibly thunderstorms. If the air is relatively dry, the cloud bases will be high, there will be no precipitation and there may even be stretches along the front where there are no clouds.

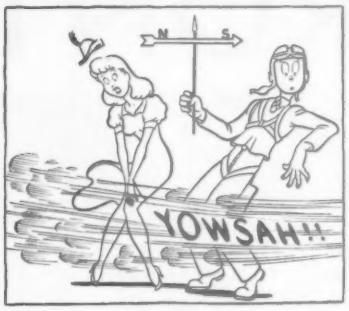
The mass of cold air sometimes moves slowly, sometimes rapidly. The slope of the front separating the two air masses depends upon the density discontinuity between them and the distribution of wind. In general, some indication of the slope of the front may be determined from its speed of movement. The slower it moves the shallower the slope, and the faster the steeper the slope. If the slope is shallow, the weather band will be wide and if steep, the band will be narrow.

The type and violence of the weather encountered in the cold front will be influenced somewhat by the steepness of

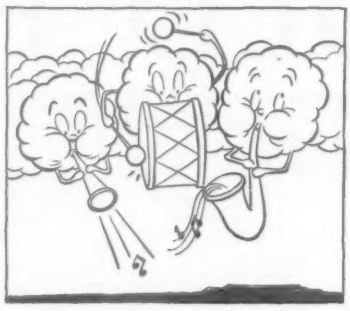
EDITOR'S NOTE

This article is a condensation of the Navy booklet "The Cold Front," prepared by the Training Division, Bureau of Aeronautics. It is No. 6 in the Navy's aerology series and is reprinted here because of its simple, lucid treatment of a complex subject—aviation weather.

A Cold Front Usually Brings . . .

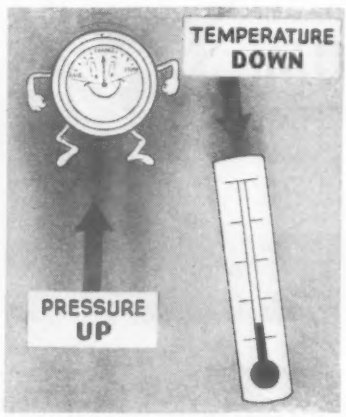


First, a strong wind from the south.



A cloud band on west-northwest horizon.

A jumpy barometer, which becomes more unreliable as the front approaches. It then rises suddenly as the front passes.



Last, a temperature fall and barometer rise.

the front, but is more directly dependent upon the characteristics of the warm air mass which is being lifted. In steep cold fronts, the weather activities are confined to a somewhat narrower area but, in general, are more violent than those encountered over the less steep fronts. The latter type may require more time to fly through but the chances are the weather will not be as bad as that which would be encountered over a steep slope.

Storms scattered along the entire cold front are the meanest kind of weather. In the old days, the frontal system was known as the "squall line," a term still used to identify a narrow weather belt that has turbulence, gusty winds, a marked wind shift and frequent thunderstorms. Violent individual storms along the front are known as "line squalls."

Fortunately for pilots, a cold front is never very wide. Although it may be hundreds or even 2,000 miles long, ordinarily its width does not exceed 50 miles. But, if the slope is shallow, it may be 100 miles wide. The pilot who flies through the zone of a steep slope front does so at a right angle so that he will remain in the danger area a relatively short time. But if he flies parallel with the front within the weather zone the chances are that the bad weather will last longer than the pilot.

Your first concern with cold fronts is being able to recognize them at a distance so that you can avoid their danger areas. The ground is a good place to observe and study the definite sequence of events which indicates the passage of a cold front. If you familiarize yourself with the sequence you will recognize without any doubt your approach to a cold front when you are in the air.

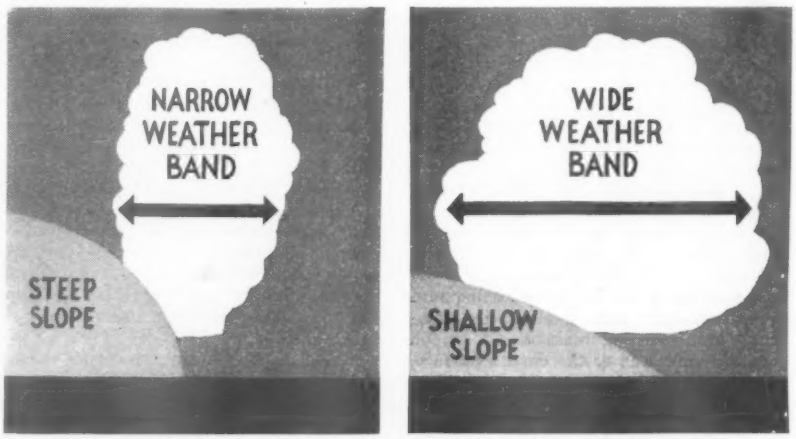
First you notice a wind from the *south*. Then a band of altocumulus clouds appears on the westerly and northwesterly horizon. If accompanied by thunderstorms or regions of violent turbulence, the winds may increase or become gusty and the barometer may become jumpy and unreliable as the front gets closer. These variations in wind and pressure are caused by convective currents associated with thunderstorms and showers along the front.

No long-time advance warning is received of the approaching cold front, as in the case of a warm front. The first real indication of its actual imminence will be a bank of threatening clouds upon the westerly horizon. After the front passes the barometer will rise suddenly and the temperature will drop immediately. The wind will shift from a southerly to a northerly direction and the overcast will begin the break into scattered cumulus clouds. Showers of lesser intensity may occur. The type of clouds and shower depends upon the characteristics of the cold air mass.

The cold front line may be masked by decks of low stratus clouds extending for many miles preceding the front. Following the front, broken cumulus clouds, which often will permit contact flying, are encountered. These cloud formations indicate which side of the front you are approaching; the deck in advance of the frontal line is higher and more closely packed than the one in the rear.

If you are approaching the cold front in a plane, the only things that can help you prepare for the kind of flying needed are the things you can actually see. If you observe a long line of cumuliform clouds on the northwest or westerly horizon, it is an indication that you are approaching a cold front. If this line has cirrus and towering cumulonimbus clouds above it, that is an indication that the cold front has scattered thunderstorms and may be pretty rugged.

If such is the case, you can anticipate all of these things: severe turbulence; icing conditions in spring, fall and winter months; a sudden and marked shift of wind, and a change in temperature. Noticing the change in temperature is vital because it indicates the change in wind and also that a necessary heading correction to compensate for drift must be made. Cold fronts are most intense in late fall, winter and spring, because at these times there exist the sharpest contrasts in temperature between the masses



Steep cold fronts are narrower but usually more violent than the shallower fronts. The latter take longer to fly through but their weather usually will not be as bad.

of cold and warm air. Icing is heaviest and thunderstorms are most concentrated at those times. However, this does *not* mean you can't have a severe cold front in the summer months.

There are three principal dangers in flying through a cold front area. The first of these is visibility, which in some cases may be reduced to zero. The heavy precipitation falling from the frontal clouds causes low scud clouds to form beneath their bases, reducing the ceiling and visibility along the frontal zone.

The second danger is turbulence, which is always present and may be violent locally if thunderstorms are scattered along the frontal area.

The cold front tends to move from the north or northwest. Warm southerly winds precede and cold northerly winds follow it. Appropriate drift connections must be made.

The third hazard is icing in the region where the temperature is at or below freezing. This condition is least dangerous during the summer months, except at high altitudes, because you don't have to worry about propeller or wing icing as long as you can choose a flight path below the freezing level. Carburetor icing may occur at any time, including summer, and there have been some serious crashes due to this cause alone.

Fortunately for the flyers, cold fronts seem to have their own book of regulations and you can depend reasonably well upon them. For instance, the worst turbulence and most dangerous icing conditions will be confined to the lower two-thirds of the main frontal cloud formation. This does not mean necessarily that smooth sailing will be found above or below this area, or that no ice will be encountered, but it does mean that no matter how rough the ride is outside this two-thirds area, it would be worse within it.

When approaching a cold front, analyze the situation carefully before entering the area, observing the surrounding cloud formations since they may obscure important characteristics of the storm. The cold front system is usually too long to permit you to fly around it. Cold front thunderstorms along the front are a series of individual storms linked by intervening clouds.

The front tends to move from the north or northwest to the south or southeast. There are warm southerly winds in advance and cold northerly winds following it. To fly a straight course through the front, you must make a drift correction to compensate for these winds on each side of the front. In flying such a front from east to west, get your course squared away so that you approach the front at a right angle. As soon as your temperature gauge drops, indicating you have crossed the front, you *know* the wind has shifted and you must make a drift correction to compensate for the wind shift.

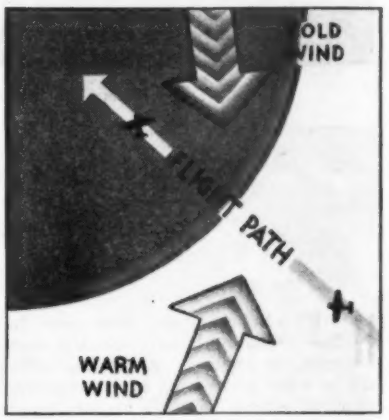
If you can't turn around and go back to avoid a cold front, you can accept one of two alternatives, flying under it or over it. In either case, *fly contact*, unless you are a qualified instrument pilot. In flying under the storm, the closer to the cloud level, the rougher the trip. Fly about one-third of the distance from the ground to the cloud base if you can, but do *not* go underneath unless you can maintain contact flight. Your probable course would be underneath if you are over flat terrain, but use extreme caution in the area of mountain ranges, assuring yourself good ceiling and visibility to see peaks and ridges clearly prior to attempting the flight.

Where possible, circumnavigate storms —*always*. Frequently it is possible to fly between adjacent thunderheads, or often a pilot may select a light spot in which he will encounter little turbulence. Once you have headed into the storm area, don't turn around on account of turbulence, rain or hail. If you do, you will have to fly through the same unfavorable conditions twice and, besides, run the risk of becoming hopelessly lost. It is well to know that when flying into an advancing cold front, particularly one with thunderstorms, the leading edge will have violent updrafts. Conversely, if entering the front from the rear, or overtaking it, severe downdrafts may be encountered. If flying in mountainous country, this rule should be well remembered.

The violence of the weather in a cold front zone is determined by the speed of movement of the front itself and the type of warm air it is lifting. There is no way for you to see these things once you are in the air, but there is a means of anticipating the front's degree of violence before you leave the ground.

Before taking off, discuss the weather situation fully with the weather bureau personnel at your city, usually located at an airport. From their knowledge of the front's movement and the type of warm air it is displacing, they can tell you if its weather will be violent and brief or mild and extensive. Their information will enable you to prejudge the weather and to anticipate where you will encounter it. The weather man can give you the answers to five questions you should ask about the front. If the weather map shows a frontal condition, ask these questions and be sure you get the answers prior to take-off:

1. Where is the front and what wind shifts are expected?
2. In what direction is the front moving?
3. How fast is it?
4. How big is it?
5. How bad is it?



Drop in temperature, and wind shift indicates the front has been crossed. Drift correction must be made on both sides.

From these answers you should be able to determine what degree of visibility will be available during the flight. Do not underestimate the necessity for adequate visibility to permit contact flight while flying in the vicinity of a cold front, be it mild or severe.

Forewarned and forearmed with this information, the average pilot should be able to negotiate a cold front situation, providing he exercises the rules of safety set forth here. END

Bomber Bait

From aloft, this dummy Lightning parked alongside a taxi-strip looks like the real thing.

Special AAF crews can build dummy airbases with planes, trucks and fuel dumps, in two weeks. But it's only to dupe the enemy.

HERE'S a behind-enemy-lines scene that has probably been reenacted many times in this war: A Japanese officer sits in a hot tent poring over a collection of aerial photos. He calls his intelligence commander to report an important finding. Japan's superior photo intelligence methods, he says, have revealed a feeble American attempt to camouflage their air activity to the southeast. Many planes are visible on the aprons of their new strip.

Subsequently, Japan's mighty bombers fly to completely demolish—16 palm logs, 30 empty ammunition crates, some burlap sacking and 12 dummy airplanes.

The number and cost of Japanese and German mistakes about American dummy aircraft cannot be estimated. Our military leaders, far from revealing the success of these devices, will not even tell whether such deception is now being used. They operate on the theory that it is more difficult for the enemy to guess "if" than to guess "where."

A look at an AAF camouflage section—like the one at the Army Air Forces Tactical Center in Orlando, Fla.—leaves no doubt, however, that Yanks know their stuff about deception. AAFTC engineers are ready at any time with the most efficient techniques of setting up dummy equipment and the most advantageous methods of employing it.

Early in the war the Japanese began turning out deceptive devices. They developed dozens of ways to simulate parked aircraft and put them out for our flyers to photograph. At the same time they took utmost care to conceal their real installations and equipment.

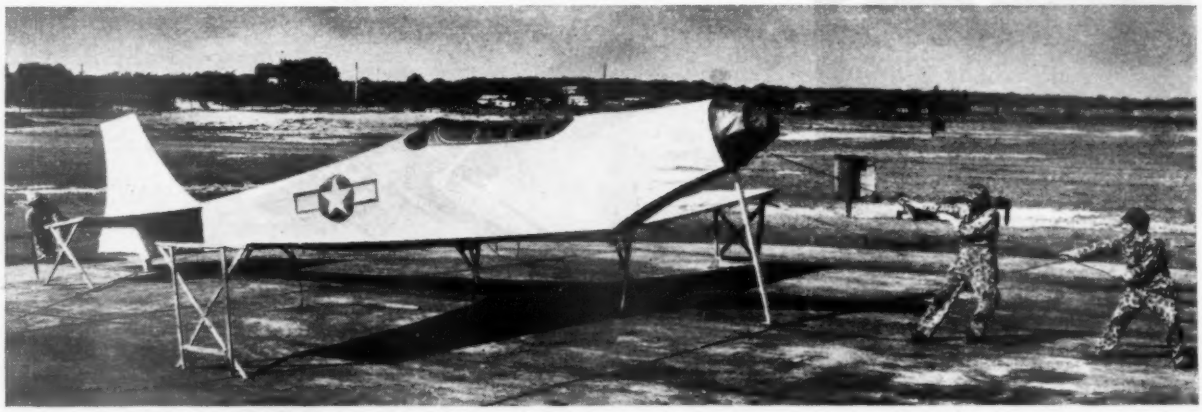
For instance, they didn't want the 5th Air Force to know they were building an airstrip within easy range of our advance fields, so they put hundreds of men to work sawing up a palm grove. Wiring together the tops of trees, they removed the trunks and built their strip under a natural canopy of palm leaves. Everything went to Tokyo's satisfaction until a *Lightning* noticed telltale tracks leading into the grove—and brought back bombers.

Actually, the Japs have at least one simple type of dummy aircraft that has given our photo interpretation officers trouble. Entrenched on a coral island, they paint the silhouette of a plane on the white coral. From 4,000 feet it is hard to distinguish from the real thing.

Perhaps no people in history have gone to greater lengths to fool other people than have the Germans. They once built nine dummy installations around Berlin, causing temporary confusion to our night raiders. German dummy planes are masterpieces of plywood and cannot be distinguished from actual aircraft, even at low altitudes. But they are so elabo-

1 Demonstrating camouflage tactics, this crew races time in setting up a dummy Mustang. Here they unload their equipment.

2 Prefabricated target-cloth sections are hinged to permit folding. Only tools needed are sledge hammers, stakes, rope.



3 The ersatz plane's fuselage is tightened by a final tug on the rope. Time required: seven minutes. Metallic glint of dummy is from aluminum paint over starched fabric. All dimensions of fake aircraft are accurate to deceive the enemy photo-interpretation officers.

rate and bulky that they present both manufacturing and transportation problems.

American dummies, on the other hand, are constructed for ease and rapidity in handling. They are prefabricated from wire, target cloth and wood. The sections and protruding parts of each plane are hinged to allow compact folding—a very important factor in transportation. Maj. S. F. Hershey, chief of AAFTC's Engineer Section (Logistics Department), estimates that an entire squadron of dummy fighters can be folded up and hauled in two 2½-ton trucks.

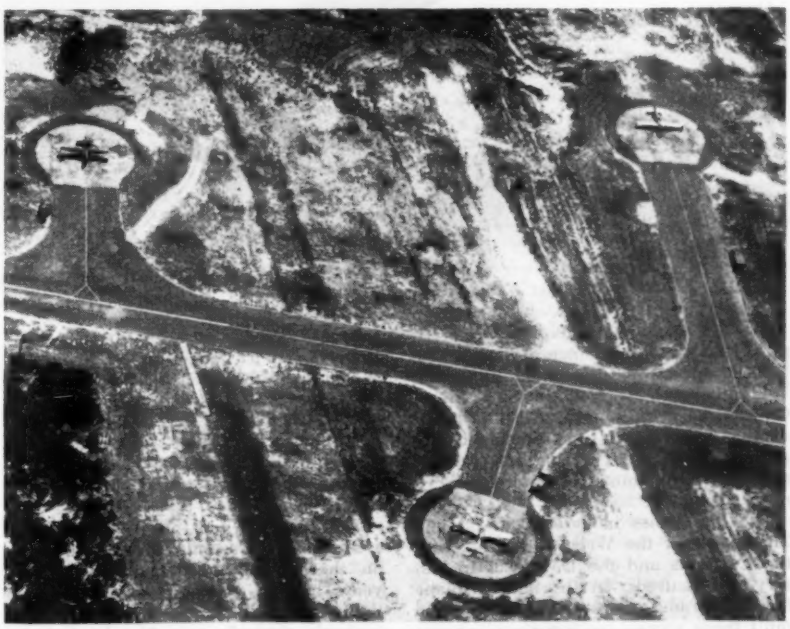
They are easily made. A crew of 30 trained men working at normal speed for two weeks can construct a squadron of 24 fighters plus mock-ups of all the attendant air base facilities such as supply trucks, gasoline dumps, antiaircraft emplacements and personnel bivouacs.

Here might be a typical procedure for building an entire dummy air strip:

Bulldozer crews move in to clear out trees and stumps. They scrape out the major strip just deeply enough for it to show up from the air, then scrape out hardstands and taxiways.

Next an operations tower is erected from lengths of bamboo or tree trunks.

(*Continued on page* 102)



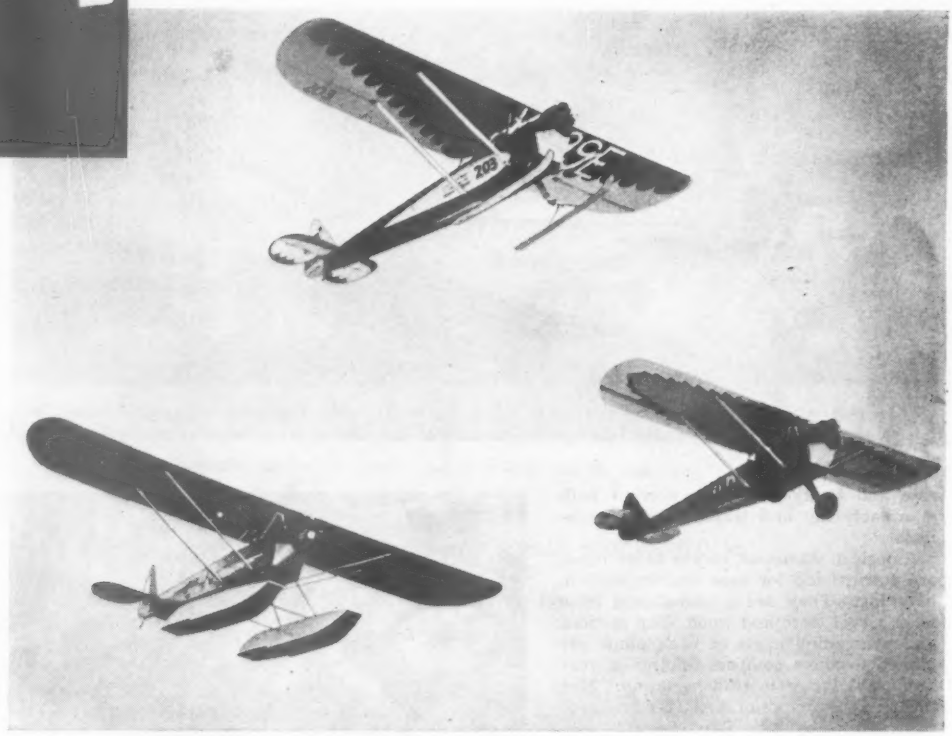
4 Would it fool you too? From a plane at 1,500 feet this field appears to be an authentic air base. Only genuine object is the truck at lower right side of photo.

Designer of the famed Heath Parasol and other aircraft, Ed B. Heath built his first plane in 1908, his last in 1931 when a new model folded up on him.

FORGOTTEN PIONEER

By WAYNE FOSTER

Ed Heath was the first designer to sell large numbers of efficient, low-priced lightplanes.



Indicative of the versatility of Heath-built planes are these models equipped with skis, pontoons, and conventional landing gear. Heath's 1918 plane's top speed was 45 m.p.h. with a seven-h.p. Thor engine.

IT IS now 14 years since a wing folded back on a tiny monoplane in a test flight over a field on the outskirts of Chicago, carrying a pint-sized pilot to his death. And it's high time someone championed that pilot as a candidate for immortality in the annals of American lightplane designing.

The big names in aviation stand out. The places of the Wrights, the Martins, the Curtisses and the Douglases in history are assured. In the light airplane field the trade names and the men who built those names are commonplace.

But who remembers that Ed B. Heath probably was the first man in the world to get 150 m.p.h. out of a 32-h.p. engine? Who recalls that back in 1908 Ed Heath built his first airplane and, moreover, flew it? Who knows that in 1918 he anticipated today's manufacture of small airplanes for the personal-owner market by constructing a machine around a seven-h.p. engine?

That one flew, too—at all of 45 m.p.h.

Things didn't seem quite right to Heath on that spring morning in 1931. For years he had produced a good line of lightplanes. Now, to meet competition in a slowly-expanding market, he had designed a low-wing. It was a neat job, with high performance. It was one of three types he planned to merchandise, a high-wing or "parasol" monoplane, one with a mid-wing, and this one, with its wing mounted on the lower fuselage longerons and braced with struts.

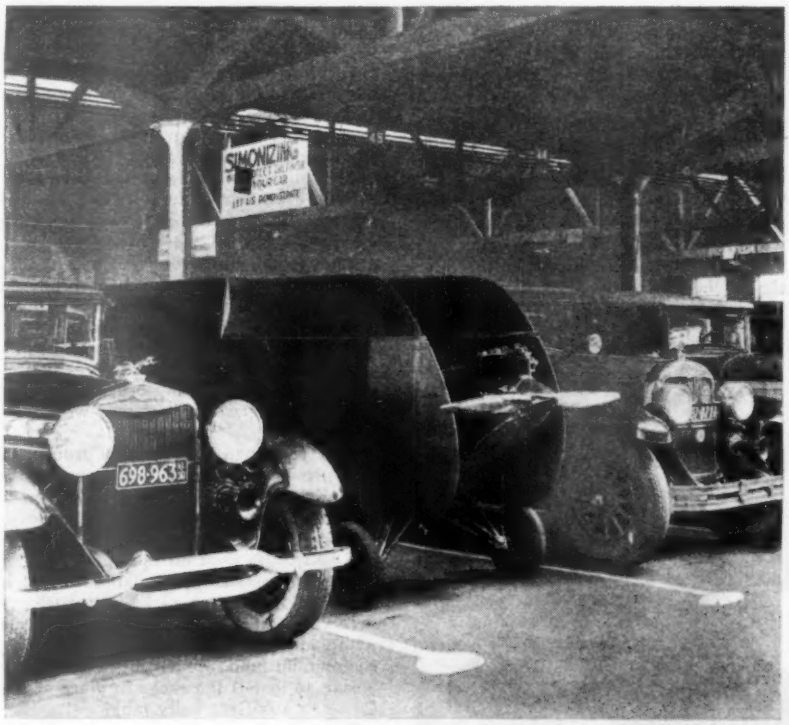
Normally Heath insisted on making the first test flight in a new plane. Oddly enough, this time he let one of his factory pilots do the initial flying.

"It's okay," the pilot reported as he crawled from the cockpit.

Another man slipped into the seat, squared away into the wind and soared aloft. He climbed to 2,000 feet and spiraled down to a feather landing.

"I like it, boss," he said to Heath.

First plane ever to be built in Hawaii, this Parasol was designed by Heath, who sold the complete plane, or plans and materials.



The folding wing is nothing new. This Heath Parasol fitted into a space no larger than that required by the automobiles of the 1920's. It was only one of Heath's innovations.

The manufacturer pulled on his helmet and dropped his goggles over his eyes. He put a foot on the wing walkway, swung a leg into the cockpit and settled into the seat. Getting into cockpits was easy for him—his five-foot frame supported a mere 110 pounds.

"I don't know why," he remarked, "but I don't feel quite right about this plane."

He opened the throttle. The plane raced down the field and lifted off. Spectators shaded their eyes to watch. It was the "Old Man" who always wrung a plane out for fair. At 1,400 feet Heath began some precision maneuvers. Now he attempted a wingover. The stresses were high, but the maneuver was perfect. Heath's always were. Then, suddenly, the right wing began wrenching loose. It snapped back against the tail like the closing of a jackknife blade. The plane wavered and began falling. Halfway down a helmet and pair of goggles flew from the cockpit and watchers glimpsed Heath's grim face . . .

It's the older generation of pilots who will remember Heath best. To him had come the barnstormers in the years following World War I to buy spare propellers for their *Jennies*. In 1928 the little man with the high-pitched voice coasted to victory in his class at the National Air Races in Los Angeles. His midget plane with a wing span of 18 feet and a Bristol *Cherub* 32-h.p. engine on its nose was a surprise model for the newcomers in competitive flying. But not to the veterans. They knew Heath as a crackerjack designer—they knew him, too, as a shrewd business man. That purse captured by what Heath called the *Baby Bullet* amounted to $1,500—the free advertising was worth a lot more.

If, in the first 30 years of American aviation history, Ed Heath was not the chief exponent of low-horsepower flying, his competitors for the title must have hidden their lights under a bushel. Design-wise he was a non-conformist. He recognized that the small airplane held possibilities as a medium of personal transportation. While others built bigger, larger, faster, more expensive aircraft, Heath puttered around with his midgets.

He had not been trained for it. What engineering education he acquired he got by trial and error. His family owned a machine shop for metal and wood-working, and in it Heath experimented. What he lacked in formal education he made up in high spirits, courage and curiosity.

Physically he was wiry. He imparted the impression of indestructibility. He had a long, sharp, inquiring nose. His face carried the permanent wrinkles of a smile, and his eyes were small and bright.

He could be spotted regularly at the airport. Except in warm weather he always wore black leather riding breeches, black, laced, high boots, a black leather cap, a blue flannel shirt and a black bow tie. When the temperature climbed he compromised with a blue shirt and cloth riding breeches, but he clung stubbornly to the high boots.

It was in the family machine shop that he built his first airplane. Aside from the fact that it flew, it deserves little comment. It looked, and was, much like the other biplanes of the period. Heath hadn't yet won individuality in plane design. But Heath had flown—and he saw the beginnings of something that, some day, might be a business. Blessed with a native wisdom, he decided to get into avia-

(*Continued on page 92*)

Fighting Laboratory

By FRED HAMLIN
Washington Editor of FLYING

Marine Air Group 31 used their Corsairs as test tubes to develop this fighter into a deadly multi-duty aircraft

IT IS perhaps an exaggeration to call the Vought *Corsair* a test tube, but ask anybody in Col. Calvin R. Freeman's Marine Air Group 31 what the test tube designation means and he'll know what you're talking about.

The Freeman group, part of Maj. Gen. L. E. Wood's Fourth Marine Aircraft Wing, made a flying laboratory of the *Corsair*, reluctantly at first, and then with enthusiasm as they began to get results. The outfit's pioneering work with the famous fighter played a major role in its adaptation as a dive bomber, bomber-strafer, fighter bomber, rocket and incendiary specialist, and night fighter—all land- or carrier-based.

They have a unique distinction—they kept their laboratory activities strictly on a fighting basis. Those changes that had to be worked out in the states were referred to experts in the states.

When they landed from a transport in the Marshall Islands on Lincoln's birthday, 1944, the group was rated as a fighter outfit. Within 12 hours the men were bombed out of bed and 1,100 of them were bombed out of all their equipment except what they had on their backs when they hit the deck.

The group was operating as a fighter unit two days after the Jap raid and within 30 days' bombing tactics had been worked out and actual bombing work was undertaken.

Mechanics were already in the Marshalls when the pilots arrived. Pilots had stayed behind at Samoa, in the Ellice and Gilbert Islands, to finish up the job there, meanwhile maintaining their own planes. They were unable to fly as a group at any time up to the Marshalls because none of our island airstrips was large enough to accommodate the group at one time. The farther north the planes got the more difficult the navigation because there were no radio aids. Navigation had to be by dead reckoning and much of the flying was over by-passed Jap islands. Hops varied up to 700 miles over open ocean. By early fall the outfit was scattered over 1,500 miles of island area.

Worse, from the men's viewpoint, was the fact that they ran into little enemy opposition. Morale suffered—Freeman had built the boys up to game-time pitch and there they sat on the islands with the game called on account of an acute shortage of enemy opposition.

At Roi, where a fight had been considered a certainty, the situation became particularly acute and it was here, in March of last year, that Colonel Freeman, a Texan who joined the Marines in 1925 and has been flying since 1929, proposed to the pilots that, for want of anything else to do, they play around with bombing. The immediate reaction was hostile—the boys considered themselves fighter pilots. Period. But the orders went out for them to try the bombing work and they did.

Only four men in the entire group had had previous bombing experience—Colonel Freeman, Lieut. Col. K. D. Kerby, Maj. W. E. Clasen, and Capt. Dale Leslie Training was sketchy—bombs were scarce and had to be used on the enemy rather than for practice. The planes were not equipped with bomb racks an a rush order was sent for them. Pilots worked with Capt. John Zouck, service squadron commander and the Group engineering officer, to install the racks in place of the *Corsair's* auxiliary belly tanks.

From the first, pilots were encouraged to submit detailed technical reports on how their planes performed under various bombing conditions and to recommend any changes in the *Corsairs* that would improve the work. These reports were the first of their kind ever to be prepared in the field to be sent to Washington and aircraft experts on the home front.

Squadrons specialized in a particular type of bombing after the racks arrived and a few practice runs were made on neighboring Jap installations. Antiaircraft fire was intense from the first and improved as the outfit penetrated deeper into enemy territory. The first big difficulty encountered was the tremendous speed the *Corsair* picked up in a dive.

(*Continued on page* 140)

Corsairs, shown on the metal-matted landing strip at Piva, are now back on carriers. Originally a fighter, the Corsair is now also used for bombing, strafing and night fighting.

VOUGHT CORSAIR
(F4U-1D)

One 2,000-h.p. air-cooled Pratt & Whitney Wasp

WING SPAN: 41 feet
LENGTH: 33 ft. 4 in.
HEIGHT: 16 ft. 1 in.

TOP SPEED: over 400 m.p.h.
RANGE: 1,700 miles
SERVICE CEILING: 35,000 feet

ratory

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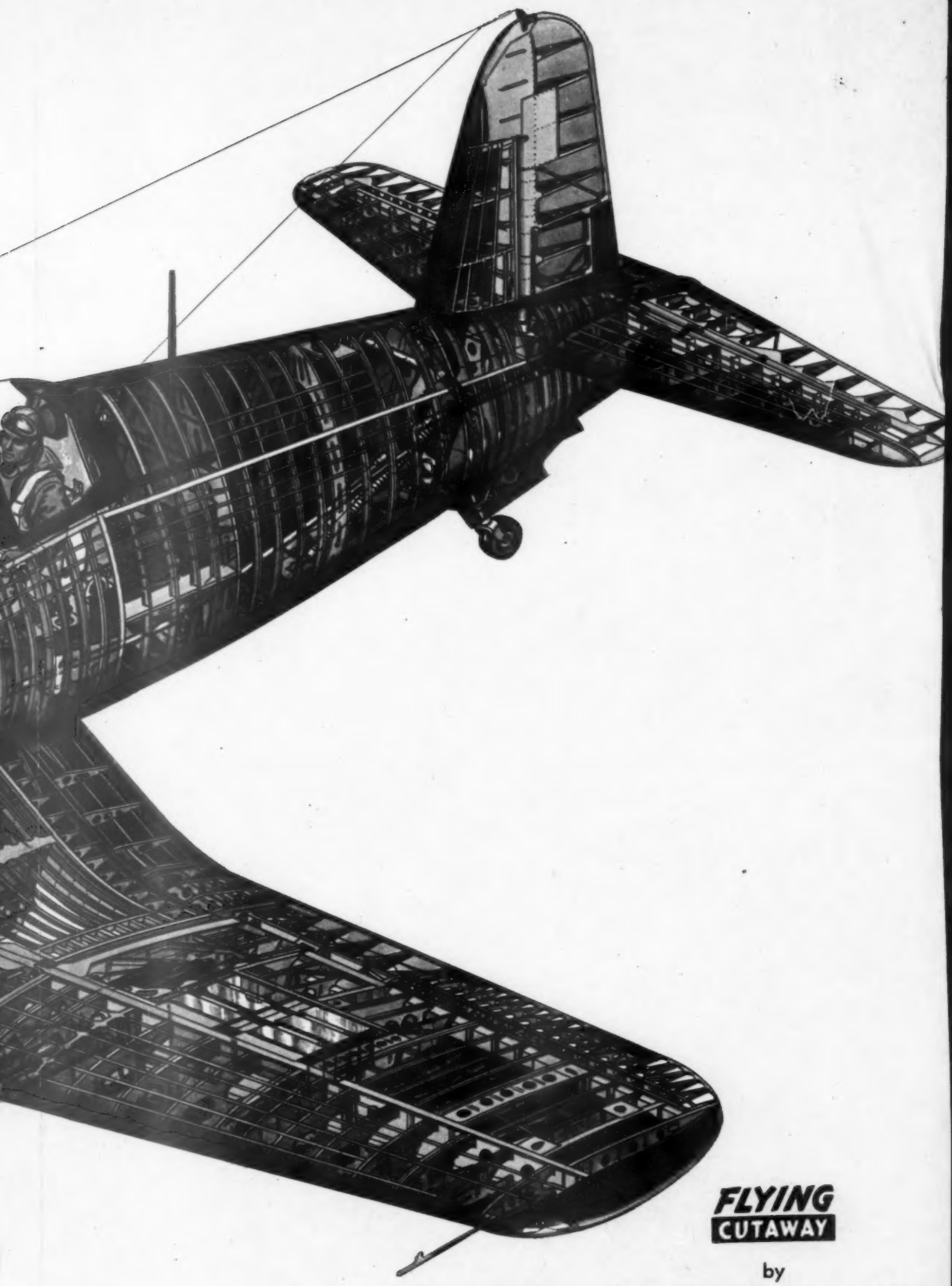
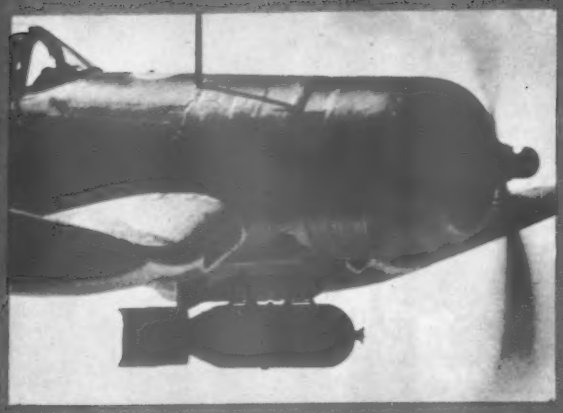


FLYING CUTAWAY

by

R. G. SMITH and R. J. POOLE

© July, 1945



One 1,000-lb. bomb under fuselage makes Corsair a deadly dive bomber. This rack can carry a droppable fuel tank (lower right).

NOW back aboard U. S. Navy carriers after many land-based months, the Corsair remains one of the world's finest single-engined fighters. Like all first line-fighters, it has great versatility, serving in the Marine Corps, as well as the Navy, as fighter, patrol plane, bomber escort, fighter-bomber (two 1,000-pound bombs), attack plane (eight rockets) and radar-equipped night fighter. Through all these variations, the Corsair retains its standard armament of six .50-cal. machine guns. Corsairs achieved great and lasting fame early in the Pacific war, with the Marines. Nearly every major Marine air victory was achieved with this airplane; all Marine fighter aces even today fly Corsairs. The version shown here — the F4U-1D — is the latest on which data can be released. However, later models will go into combat soon. Corsairs are manufactured by Vought at Stratford, Conn., and by Goodyear (Navy designation: FG) at Akron, O. The Corsair's inverted gull wing makes it one of the most easily-recognized aircraft. This unusual wing design was adopted to enable the plane to use a short, comparatively lightweight landing gear, and to keep the Corsair's folded-wing height to a minimum for aircraft carrier storage.

Corsair tail wheel holds plane's tail unusually high, giving pilot best forward visibility. Note arresting gear tail hook.

Have y

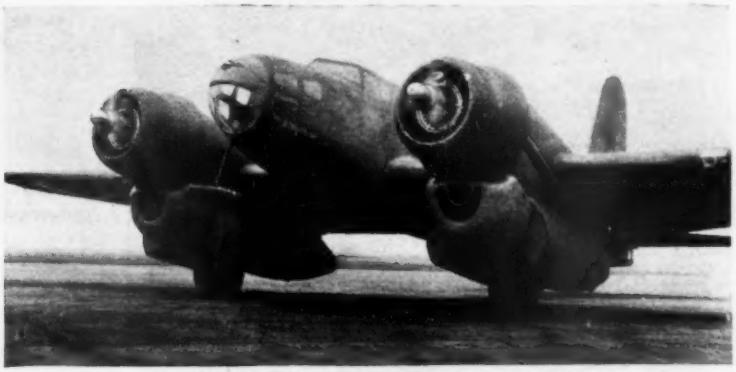
This carrier-based British Seafire is being fitted with four cordite rockets (two to a side) that are used to get the heavily loaded plane in the air.

Shot down by American flyers in the Philippi
floatplane has a 900-h.p. engine. Top speed

Have You Seen?

This carrier-based British Seafire is being fitted with four cordite rockets (two to a side) that are used to get the heavily loaded plane in the air.

These blue-black Hellcats (F6F-5N) are part of a carrier-based night fighter squadron. Bulges near wing tips are radar. Also note their flame-damping exhaust stacks.



An obsolete Douglas Dragon (B-23), this Army bomber was fitted with specially sealed compartments so that fuselage pressurization could be tested in the air.

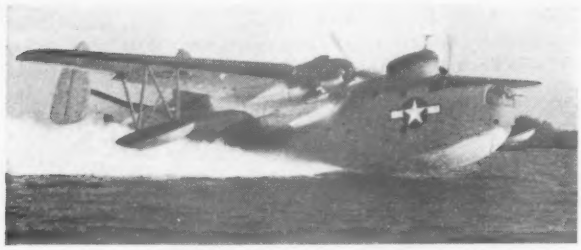
Shot down by American flyers in the Philippines, this Jake floatplane has a 900-h.p. engine. Top speed is 216 m.p.h

HAVE YOU SEEN?

(CONTINUED)

Bombs from an AAF Marauder narrowly missed this Fw-190 in raid over Germany.

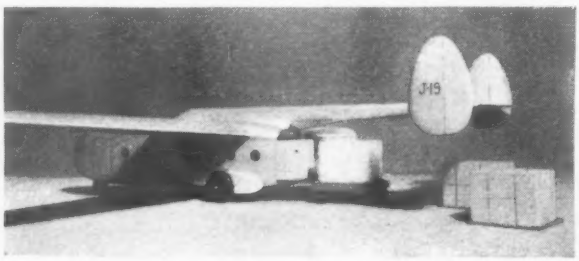
First released photo of system shows British Walrus catapult plane returning to its ship. It taxis onto towed net which hooks onto hull, is pulled alongside then lifted aboard by crane.



Latest Martin Mariner (PBM-5) has 2,000-h.p. P&W engines, greater range and load. A PBM-5 recently flew over 28 hours non-stop.

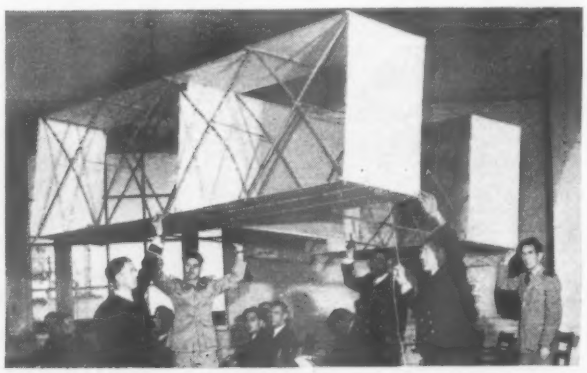
Boeing YB-40 is a 14-gun bombless version of the B-17. It was unsuccessful attempt to stave off German fighters attacking bombers.

Unusual photo shows Flying Fortress bombing German target while in a turn. Popular belief is that bombers must fly level to bomb.

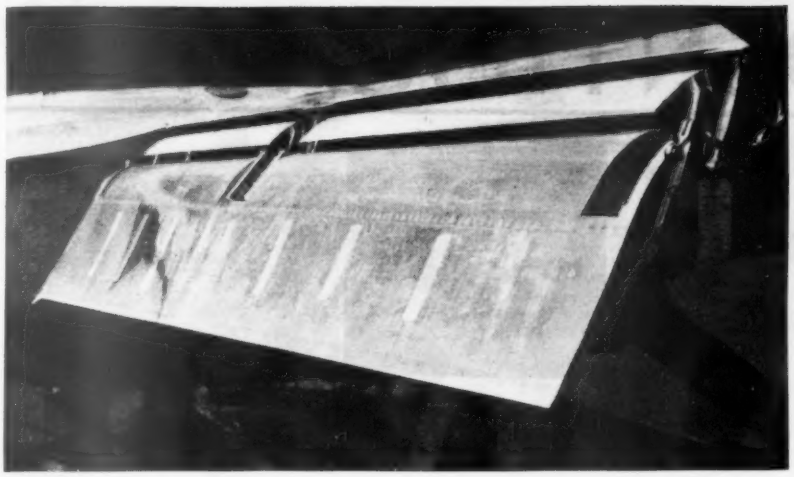


Proposed cargo glider of Los Angeles firm is designed to carry five tons of cargo. Span is 95 feet. Production price: $65,000.

New Kellett XR-8 helicopter has 245-h.p. engine, twin rotors that mesh. Gross weight is 2,975 pounds, fuselage length, 22 ft. 7 in.

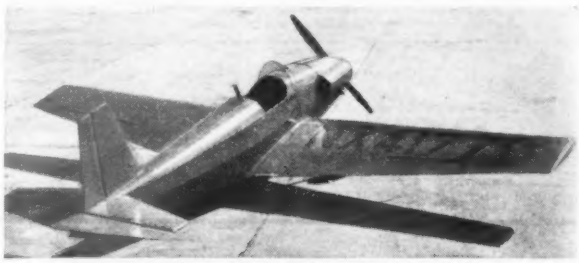


Ten-foot kites on piano wire are flown by USMS merchant ships to ward off low-flying Jap planes. Kite wires have sheared off wings.



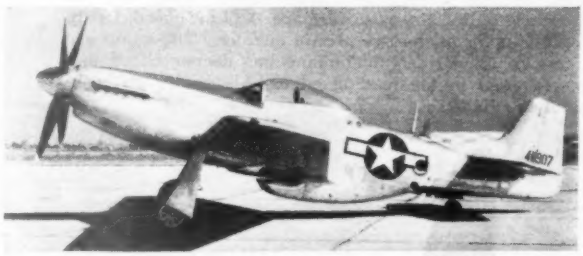
Slotted flaps of the Douglas Invader (A-26) are necessary because of its high wing loading. They give plane high-speed wing when retracted, assure safe landing characteristics.

This P-38 belly tank holds 258 gallons of fuel, can be modified for cargo or troops.

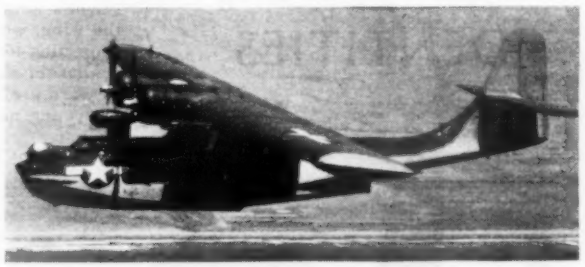


"Skyhopper" is experimental lightplane with 50-h.p. engine. Cruising speed is 110 m.p.h., range 275 miles. Estimated price: $1,000.

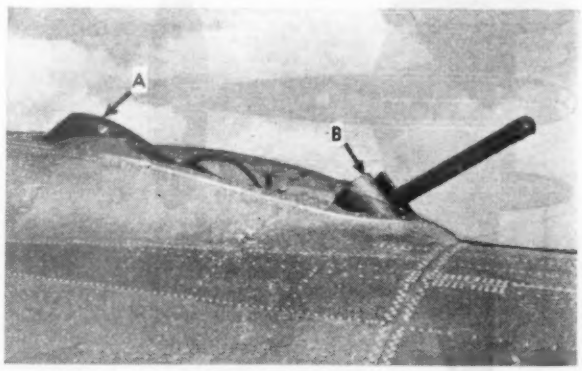
British Gloster E 28/29 was world's first jet plane to fly. Intake is in the nose, jet in tail. It was used for flight experiments only.



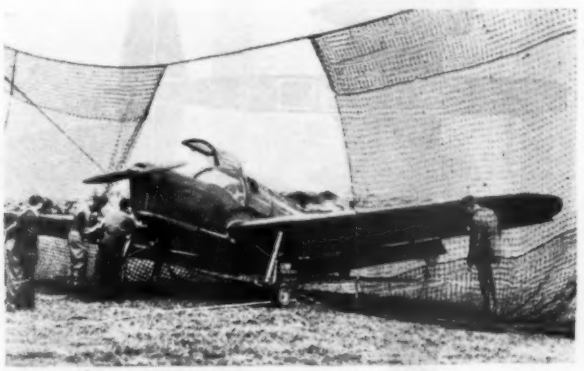
This photo-plane version of the Mustang is the F-6. It has several cameras in fuselage (note windows), retains all its armament.



Latest Catalina is PBY-6A. It has redesigned nose and tail. Range has been increased to 3,000 miles. Teardrop above cockpit is radar.

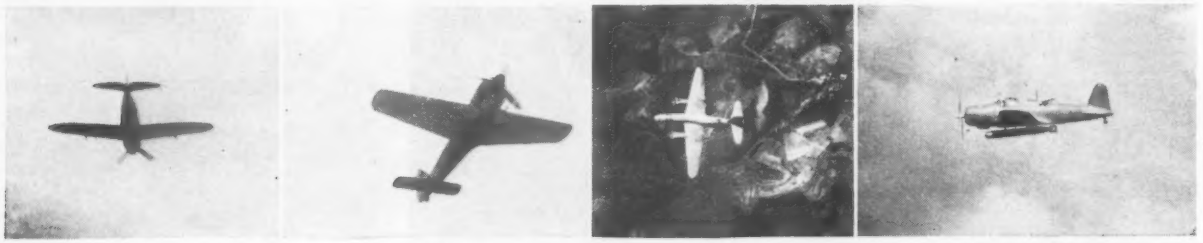


Dorsal gun on Flying Fortress now is in new Boeing-designed mount (B) making gun easy to move. Spoiler (A) deflects air off the gun.



In recent tests in England, this Miles lightplane was flown into a vertical net across small field, stopped on the spot, undamaged.

FOR IDENTIFICATION



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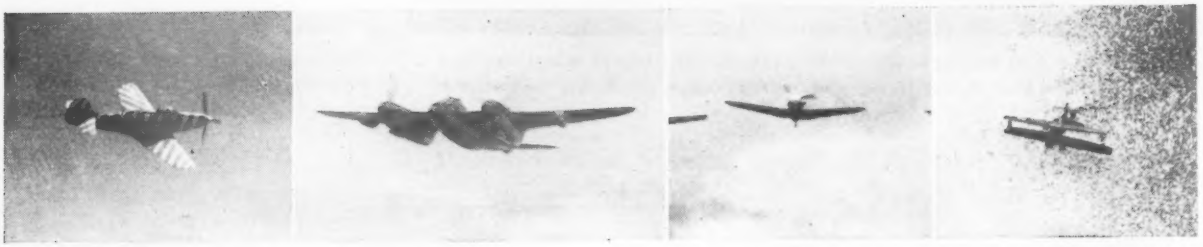
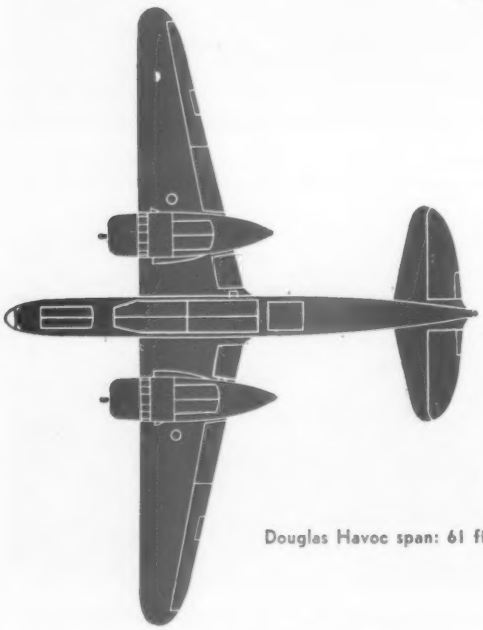


5 6 7 8

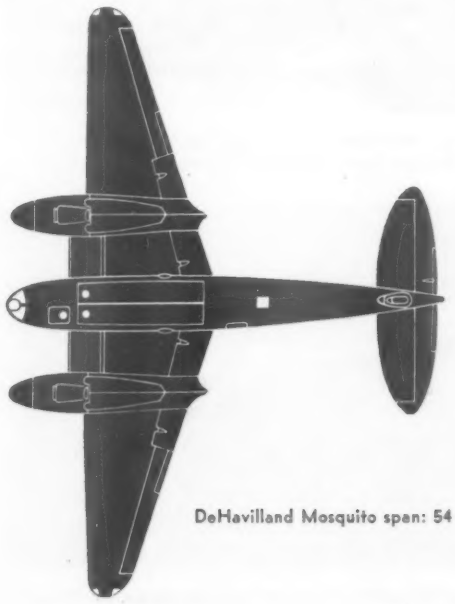
The planes are: 1. Republic *Thunderbolt* (P-47D); 2. Focke-Wulf Fw-190; 3. Martin *Marauder*; 4. Nakajima Kate; 5. Bell *Airacobra*; 6. DeHavilland *Mosquito*; 7. Messerschmitt Me-109G; 8. Consolidated Catalina

MISTAKEN IDENTITIES

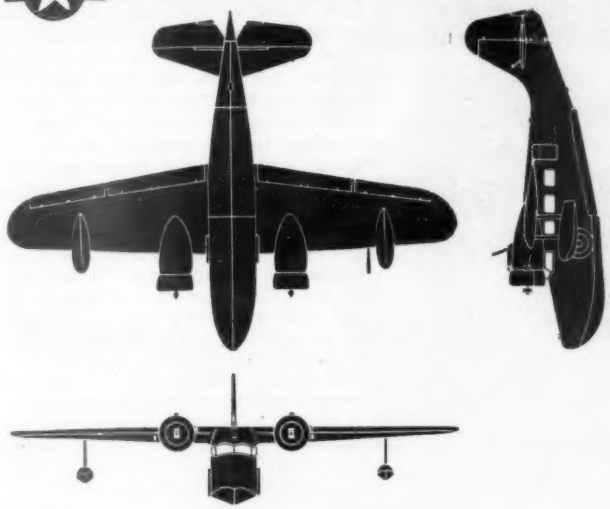
THESE two Allied aircraft are markedly similar in appearance, particularly when seen from below. Note, too, that they also are very similar in size. However, there are several important recognition features that clearly mark the differences between the *Havoc* and *Mosquito*. The Havoc's long slender fuselage projects far ahead of the leading edge of the wing, while the more bulky *Mosquito* fuselage is blunt-nosed, its tip projecting forward only as far as the two *Merlin* engines. The wings are similar in shape, though the British monoplane has deeper chord and forward-projecting radiators in the leading edge. Also note, the rear-projecting nacelles of the *Havoc*.

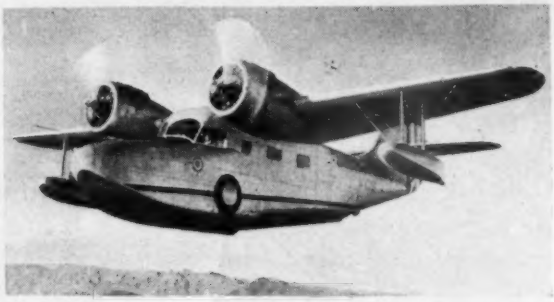


Douglas Havoc span: 61 ft. 4 in.



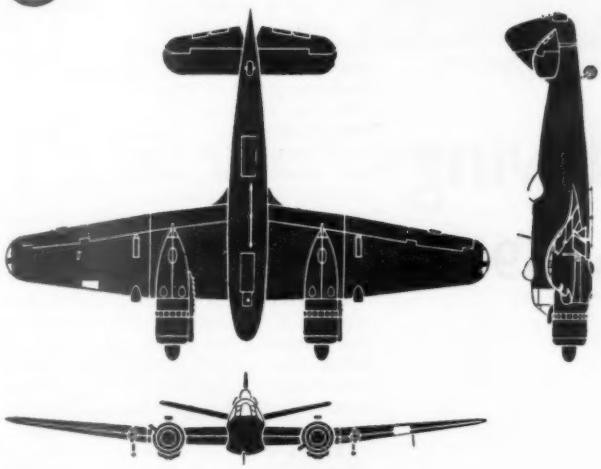
DeHavilland Mosquito span: 54 ft. 2 in.





GRUMMAN GOOSE

The most widely-used small amphibian in the U. S. armed forces, the *Goose* is known as the JRF in the Navy and OA-9 in the AAF. It is powered by two Pratt & Whitney engines of 450 h.p. each. Wing span is 49 feet, length is 38 ft. 4 in. and height, 12 feet. Normal gross weight is 8,500 pounds, weight empty is 5,400 pounds. Top speed is 201 m.p.h., cruising speed, 190 m.p.h. Range is 800 miles, ceiling 22,000 feet. The *Goose* also is used by the RAF and certain Latin American countries. The manufacturer's designation is G-21.

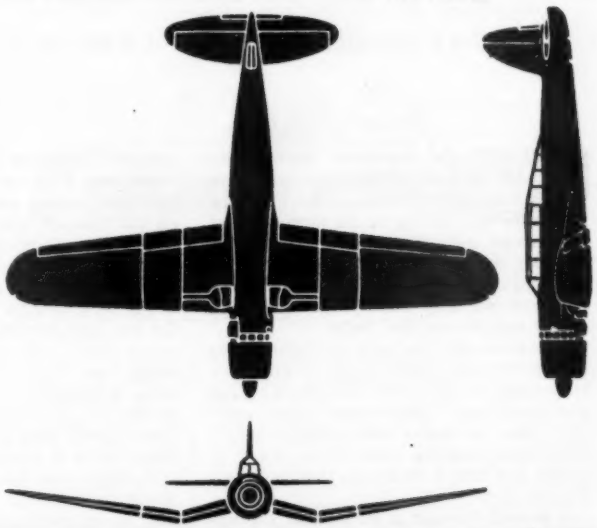


BRISTOL BEAUFIGHTER

One of the deadliest of all Allied fighters, the RAF's veteran *Beaufighter* still is in wide use and will play a prominent role in the Pacific war. It has extremely heavy armanent: four 20-mm. cannon, six .303-cal. machine guns, and can also carry eight rockets and an 18-inch torpedo. Span is 57 ft. 10 in., length, 41 ft. 4 in., height, 15 ft. 10 in. The two 1,600-h.p. *Hercules* engines give it a top speed of 350 m.p.h. at 14,000 feet. Gross weight is 21,000 pounds, weight empty is 13,800 pounds. Range is 1,300 miles

GRACE

Little factual data is available on this new Jap torpedo bomber, although photographs and intelligence reports from the combat areas have enabled us to piece together a few facts. The engine is reported to be a Nakajima Homare of about 1,800 h.p. Span is 47 ft. 3 in., length, 37 ft. 7 in. An unusual recognition feature is the plane's inverted gull wing which, of course, will cause it to be confused with the Vought *Corsair*. Jap name for *Grace* is "Ryusei," which means "Shooting Star."



NEWS NOTES

These facts are known on the Brewster XA-32A: It had one 2,000-h.p. Pratt & Whitney engine, span of 45 ft. 1 in., length of 40 ft. 1 in. It was a single-place midwing attack bomber. Cruising speed was about 200 m.p.h. The Lockheed XP-49 was an experimental fighter powered with two 1,350-h.p. experimental liquid-cooled engines. Span was 52 feet, length, 40 ft. 1 in., height 9 ft. 7 in. Cruising speed was over 300 m.p.h. The cockpit was pressurized. The basic design resembled the P-38.

An airline pilot since 1931, Captain Sheridan's flying career dates back to 1917 when he was a flight instructor in World War I. His log book shows more than 17,500 hours.

I Learned About Flying From That!—No. 69

By
HIRAM W. SHERIDAN
Captain, American Airlines

Such an icing phenomenon couldn't occur, said the physicists—but this pilot watched it happen.

I SNUBBED the transport around into take-off position after having run up both engines on a final check. A very light rain was falling at the airport there in Chicago and, of course, small droplets of water were standing all over the upper surfaces of the wings. The ground temperature was only slightly above freezing —that was the critical factor.

We took off, the plane laboring as though it were pretty badly overloaded. It mushed in the climb and its airspeed remained low. After some time, however, we reached a safe altitude and I went back into the cabin to get a cup of coffee and take a look at a blonde to settle my nerves.

I peered through a window at the upper surface of the wing—it was covered with ice. The stewardess told me she had been sitting on the edge of her seat on the take-off watching that wing. She saw the ice form—*before* we had gotten into the air.

The droplets of water had not frozen in the form of little round balls. Instead, the ice had formed in a flat sheet with many holes, like a piece of lace. I decided right there that I had better get some information on this sort of thing. At the first opportunity I told the story to Capt. Larry Harris, secretary of the Air Line Pilots Association in Chicago. He said there was nothing new or strange about the incident. Nevertheless, I found that the majority of airline pilots did not know about problems involved in it.

Cold water on the wings of a plane does not seem especially startling at first glance. But it does give rise to grave possibilities. All pilots who have been flying any length of time can recall unsuccessful attempts to take off with frost on the wings. In such attempts, lift was interfered with and the flights had the tendency to be short and snappy—especially the latter.

While frost is known to be a hazard, water on a plane's wings is not generally conceded to be dangerous. Under certain conditions, however, moisture already existing on the wings freezes at the time of take-off, presenting an entirely new angle to the icing hazard. This potential threat to aircraft demands far more consideration than it has received.

A pretty fair guess as to what happens to those globules of water on the upper wing surface may be evolved from study of the laws of physics as expounded by a certain Mr. Boyle. He has the scientific world convinced that the air immediately adjacent to the upper surface of the wing is moving much slower than the airplane itself, but it is moving. In sliding over the airfoil, air pressure acting on the water globules is reduced and the increased air flow immediately above stimulates evaporation. The total effect is to lower the temperature on the wing surface considerably. In short, Mr. Boyle's law tells us that with reduction of pressure we must have a reduction in temperature. At a given critical temperature there is enough reduction in temperature caused by the wing's rapid acceleration on take-off to change those droplets of water into a sheet of ice.

Only recently at Detroit I had another experience. The temperature was slightly above freezing and a very light snow was falling that melted instantly on contact with the ground or with the wings. Just to humor me, the mechanics wiped off the wings—the left one first, then the right.

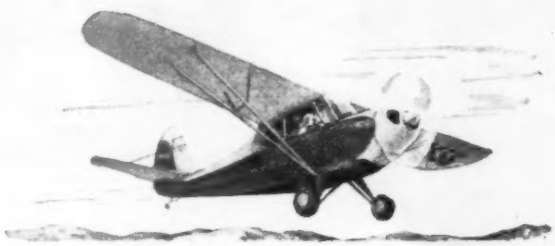
I promptly taxied out to the proper position and made the take-off run. The procedure was normal—or it seemed to be so—but when we were in the air I had to use eight degrees of aileron tab to get lateral trim, moving the control to bring the left wing up. Here's how I figured it out. The left wing having been wiped off *first* had picked up more snow which melted into water than had the right one.

Going back into the cabin soon after the take-off I looked at the wings. There was hardly enough ice to see. At the end of a half hour I had taken off some two degrees of trim—evidently the ice was sublimating. An hour and 10 minutes later all of the ice was gone and all eight degrees of trim had been removed.

I wrote to a physicist about the phenomenon. He made some calculations and wrote back to me in a manner that convinced me that what I had experienced cannot happen with equations—only with airplanes. When I get a little older I am going to take up equations instead of airplanes because they are safer.

But I thought I had better make a report for the benefit of those pilots who want to grow a little older too. END

I'll be the Crew, and the Pilot, too!



1. When the war's over, I'm buying a plane of my own with some of the dough I've saved. (It doesn't take much.) I may pick the Chief, with its high-wing design—or the Eagle, with room enough to carry the family on a hunting and fishing party just about the way you'd take them in a car. Or maybe . . .

2. One of the other models they're still testing in the wind tunnel. Aeronca got the savvy out of war work, added to more than 16 years of experience before that. They're all out for war now. That's why they've won the Army and Navy "E"—and they're the only light aircraft company to get it. They'll have postwar models with features you've never thought of before.

3. They've even prepared booklets that answer many of the questions related to centrally located airfields, and service and gas and oil. There's also an Aeronca book that tells about the new planes. There's nothing to stop you from sending for them both. Use the coupon!

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has an important message for air-minded people

Department F-7,
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Send me your valuable booklets:
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Canned TO PRESERVE

Buy More War Bonds and Stamps

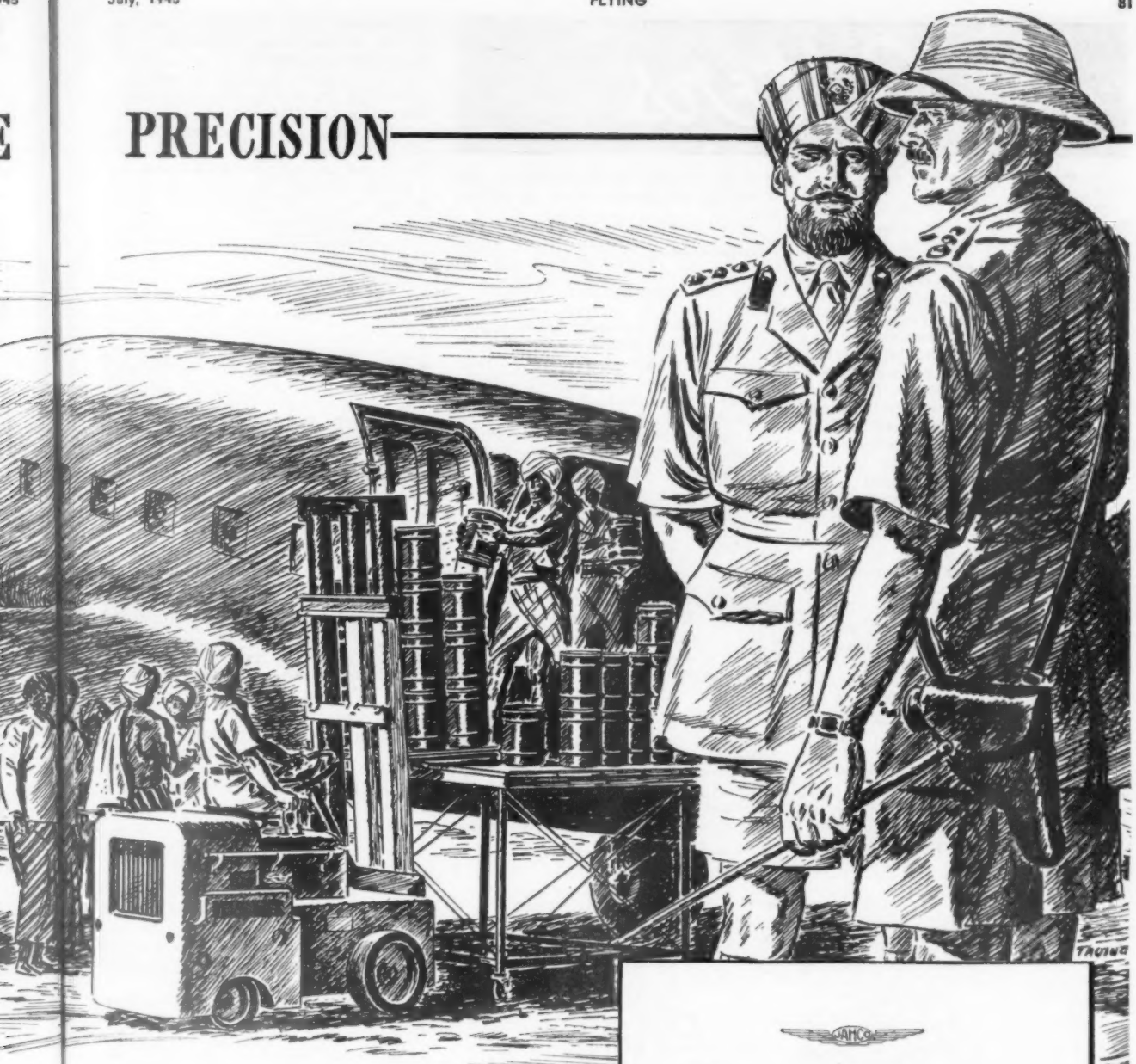
ERROR of a ten thousandth of an inch in the directional gyro might throw a plane far off its course—lose it and all its occupants. Yet such delicate and precise instruments must make long, rough journeys to a war half way around the world —and wait months perhaps before seeing service.

Not satisfied with designing and producing the finest of aircraft equipment, Jack & Heintz engineers were determined to protect it from dirt, dust, moisture, shock—any factor that might destroy its fine accuracy. Working with the Packaging Container Division and the Engineering Division of the Air Technical Service Command, they developed a revolutionary new means of packaging—literally "canning"—to preserve precision.

Precision instruments, starters and generators are floated in rubber-impregnated hair cushion or pulp castings in the can. Silica gel is included to absorb all inside moisture. Then a special J. & H.-developed machine clinches the cover to form an

Jack & Heintz Inc., Cleveland, Ohio, manufacturers of aircraft engine starters, generators,

PRECISION



air-tight, water-proof seal. Where conventional packing was good for six months, Jack & Heintz canning protects for a minimum of two years . . . in steaming jungles as well as in sub-zero cold.

This idea, like hundreds of other Jack & Heintz methods, has excellent peacetime applications—export marketing, for example. In the meantime, it will be used to guarantee delivery to our fighting men of all the precision, performance and long life built into vital aircraft equipment by Jack & Heintz.

JACK & HEINTZ
Incorporated

gyro pilots, gyro flight instruments, magnetos, motors.

Letters

WANTS TEETH IN CAA RULES

Sirs:

From T. P. Wright's article on private flying in your April issue, I gather that the CAA has great plans for the future. I wonder how they can expect to control things well enough to make any of their plans work and still promote safety?

My varied and many observations of the CAA is that the inspectors are unable to enforce present regulations, even during the war-time low point of activity —for example, the rationing of aviation gasoline. I have seen fuel put in planes during the day and drained out at night by pilots, mechanics and others for use in automobiles.

Pleasure flying was supposed to be banned. Yet at every airport passenger hopping is going on, many times under the guise of "instruction" or "demonstration" and, at some places, openly.

Log books of engines are a joke. The universal practice is to log only half the time, since the average owner doesn't want to spend money on overhaul or checks, loss of safety notwithstanding.

One plane I knew of hadn't had a periodic for three years, yet is busy every week-end. There was nothing the local inspector could do other than time every moment of the plane's operation himself, which he couldn't do.

If Mr. Wright's prophesy of 100,000 to 500,000 planes in the future comes true, and the CAA program to boost private flying among the average-income group is to be a reality, the powers-that-be had better put nice, sharp teeth in the regulations.

AN A&E MECHANIC

Annapolis, Md.

AIRPORT FIRE

Sirs:

I noted with particular interest your picture feature in the June issue on "How *Not* To Run An Airport." I am a private pilot and have noted similar scenes at every field I have visited. What irks me is the fact that almost all the careless fixed-base operators successfully get away with their slip-shod methods of serving the flying public.

You have my thanks and, I am sure, that of every private pilot.

F. B. BUSH

Fort Worth, Tex.

● Not all of those operators surveyed in "How *Not* To Run an Airport" have successfully evaded unpleasant consequences of their disregard for common rules of safety. One of the four airfields investigated had a $25,000 fire before our June issue was even off the press.—ED.

AS ONE SMITH TO ANOTHER

Sirs:

It was with extreme interest that I read Lieut. (jg) George H. Smith's account of "Twenty Days on a Raft." At the point in his article where the rescuing *Catalinas* arrived, my reading was interrupted with tears, for I am the mother of Lieut. (jg) George B. Smith who spent 18½ months as a co-pilot on one of the flying boats in the areas described by the author. My son is now a *Mariner* pilot in the Philippine theater.

While my boy was flying the *Catalina*, his pilot was also named Smith—"Big Smith and Little Smith of Squadron 14." I cannot help but wish that the author of the story had been rescued by my son, adding to his crew's list which gave them a record of the most rescues in a Dumbo.

The Naval FLYING issue of October, 1944, gave me a tremendous thrill when I saw a picture of my George Smith

reaching across the table at the Snack Bar at Glen Innes, New Zealand.

LORNA D. SMITH

Glendale, Calif.

● Here is the picture to which Mrs. Smith refers. Her son, Lieut. (jg) George B. Smith, is on the right.—ED.

PROUD GOLDFISHER

Sirs:

Your letter with my Goldfish Club membership card was delayed several places along the line but finally reached me. You'll never understand how proud I am to be a member of this distinctive organization.

Some time ago I read, I believe in FLYING, that the British had such a club and wished then that we Americans had a similar club. Now I can feel that someone recognizes us fellows that got "dipped in the drink" while doing our stint for Uncle Sam. Thanks very much for the honor.

RAYMOND SHEETS, AOM2/c

Whidbey Island, Wash.

● For Goldfish Club qualifications see page 92 of May issue of FLYING—ED.

WARPLANE NAMES OK

Sirs:

Replying to the letter, "What's in a name"? sent in by H. R. Binet ["Letters" FLYING, April, 1945] I think the names we've applied to them are sufficiently apropos. How do you think our airmen would feel flying planes which were literally bristling with machine guns and cannon, labelled with names such as *Orion, Sirius, Altair,* etc.?

As for renaming the *Superfortress*

(*Continued on page* 148)

FLYING

"Downed a new Jap fighter today that looked a helluva lot like a P-47."

Finish the Fight – with War Bonds

Double trouble—for Japs

Bombs are away . . . bomb-bay doors closing on those empty twin caverns in the big ship's maw. In 40 seconds a shattering explosion will occur in a Japanese factory, 25,000 feet below. . . ."Mission accomplished."

The Boeing B-29 Superfortress is designed for a vital purpose: to carry a big load of explosives farther and faster, with the ability to fly at higher altitudes, than any other bomber in the world.

The huge, double bomb-bays are the B-29's reason for being. Around them Boeing engineers have built a great airplane. But the superb, aerodynamically clean wing and body, the turbo-supercharged engines, the pressurized cabins, the remote-control guns all serve one goal—*to deliver the bombs.*

Today Superfortresses of the 20th Air Force are pounding enemy industry with steadily mounting fury. In a single day the big planes have roared in over several different targets, from Singapore to Nagoya, and let go tons of destruction.

Manning the B-29 squadrons are picked crews – skilful, cool-headed and courageous – as fine a body of flying fighters as can be found on earth or in air. The Superfortresses, like the Flying Fortresses, represent Boeing's effort to give American airmen the best possible weapons for accomplishing their difficult and hazardous missions.

When final victory is achieved, Boeing's broad experience in research, design, engineering and manufacture will once more be applied to peacetime aircraft. Of any such product you can be certain . . . if it's "Built by Boeing" it will lead the way.

DESIGNERS OF THE B-29 SUPERFORTRESS • THE FLYING FORTRESS • THE NEW STRATOCRUISER
THE KAYDET TRAINER • THE STRATOLINER • PAN AMERICAN CLIPPERS

BOEING

THE LIBRARY

THE AIRCRAFT ANNUAL—1945, by David C. Cooke; published by Robert M. McBride and Co., 116 East 16th Street, New York, in 1945. 288 pages. Price $3.

THE AVIATION ANNUAL OF 1945, by Reginald M. Cleveland and Frederick P. Graham; published by Doubleday, Doran, 14 West 49th Street, New York, in 1945. 205 pages. Price $3.75.

Here are two more in the already weighty parade of aviation annuals. They both purport to cover the same general subject—what went on in aviation in 1945—and each has its own style of presenting this information. Both make much of the statistical surveys and other materials released in profusion by publicity organizations in all parts of the aviation industry. Both lean heavily on official photographs issued by the armed forces; many photographs long since familiar to the aviation reader are again duplicated in these two volumes.

Mr. Cooke presents his information very much as he collected it. Messrs. Cleveland and Graham go in more for the "expert analysis" type of thing. The Cooke work is not indexed, the other is. The Cooke volume is a fairly straightforward effort; Cleveland and Graham go in for the inevitable rash of "big names" to help put their book across. They devote a considerable amount of space to this overdone technique, their book containing no less than 11 "name" forewords, ranging from General Arnold to John W. Hill, head of an aviation publicity organization.

MAX KARANT

AIR TRANSPORT AND CIVIL AVIATION, edited by the Rt. Hon. Lord Brabazon of Tara, P.C., M.C.; published by Todd Publishing Company, Ltd., London and New York. 311 pages. Price $4.20.

Here is a British publication comparable to our own *Aircraft Year Book* published each year by the Aeronautical Chamber of Commerce of America.

Canadian aviation has been exceptionally well presented by the three papers published in Section 1, particularly the one by James T. Bain on "Development of Post-War Aircraft." This paper discusses the airline operator's post-war picture, not only for Canada but for every other nation.

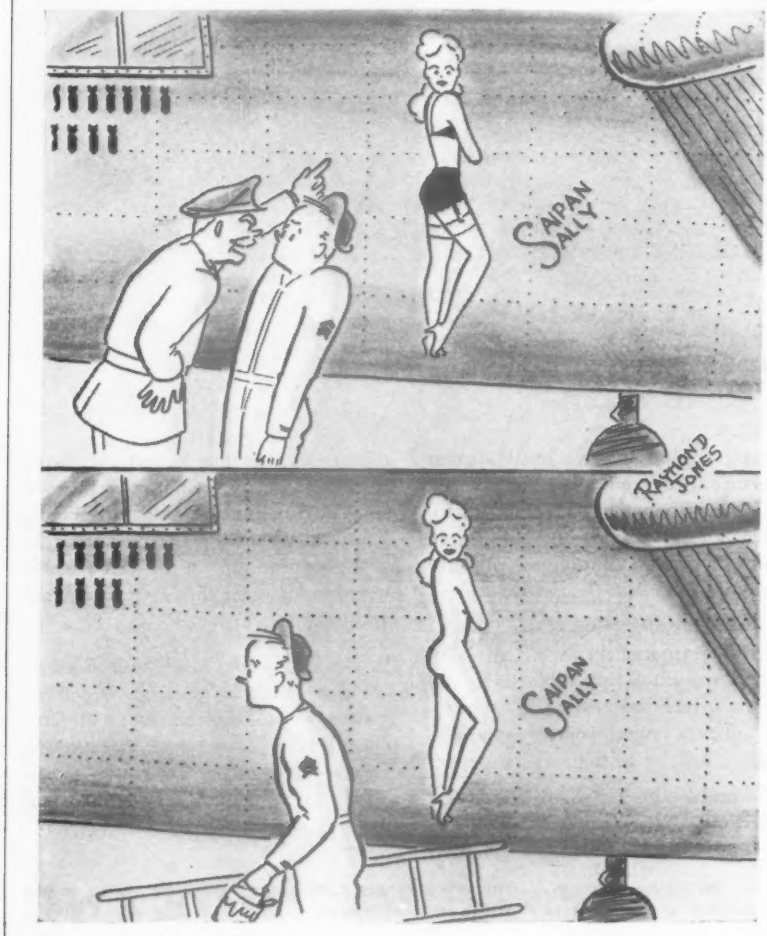
"What is Wrong with British Civil Air Transport?" by W. Hudson Fysh I found a bit amusing. Before one can safely boast about his products, he must first design and manufacture products which merit such praise. In my estimation, this has not been accomplished by the British. During the past 10 years Great Britain has not produced any transport aircraft equal to those designed and built by the United States.

It is unfortunate that the editors failed to include a resume of engine design trends and developments by Sir Roy Fedden who is unquestionably one of the best-informed persons on this subject.

The section covering official directories is incomplete and, to some extent, factually incorrect. For instance, our present CAA Administrator is T. P. Wright—and the executive assistant to the CAB Chairman is not J. Francis Reilly who resigned well over six months ago.

Nevertheless, I feel that here is a book which should be read by every executive in the air transport industry. It does give a fairly accurate record of the thinking back of British air engineering and planning.

CHARLES FROESCH
Chief Engineer, Eastern Air Lines



SHORT VIEWS

TWO HUNDRED THOUSAND FLYERS, by Willard Wiener; published by The Infantry Journal, 1115 17th Street N.W., Washington, D. C., in 1945. 210 pages. Price $2.75.

The story of the unparalleled production of aircraft by American industry is widely known, but there is a phase of production about which little has been told—the production of the pilots to man those planes. Mr. Wiener's account of the Army's Contract Pilot Schools gives one of the first overall pictures of how flying instructors, ground-school instructors, and mechanics teamed with the Army to train British, French, Chinese, Dutch and Brazilian flyers as well as our own aviation cadets. Spiced with humorous incidents and charged with a bit of heroism, the book comprises an interesting and an important chapter in the history of the AAF.

FIGHTERS UP, by Eric Friedheim and Samuel W. Taylor; published by Macrae-Smith Company, Philadelphia, Pa., in 1945. 275 pages. Price $2.50.

A factual story of the operations of Eighth and Ninth Air Forces Fighter Commands in the European theater that has been given story-book treatment. Its compilation was originally a project of the U. S. Strategic Air Forces in Europe.

THE STORY OF THE U. S. ARMY AIR FORCES, by Jim Ray; published by the Garden City Publishing Co., Inc., Garden City, N. Y., in 1945. 54 pages. Price $2.

This summarization of our gigantic air operations in this war is far too incomplete to be of any real value. Only the author's skill at illustration and story telling makes the book worth the half-hour required to breeze through it. END

...graduate pilots only!

The Ferrying Division of the Air Transport Command is "big business" in military flying. It takes "post-graduate" pilots—pilots who are tops in instrument flying skill—to handle this job.

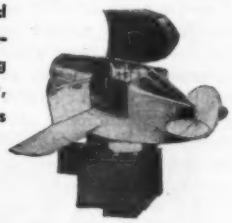
The big C-54's which cross the Atlantic in winter, link the foggy Aleutians to the mainland, or battle the elements over the Himalayan "Hump," encounter weather at its worst. And there's no turning back; their precious, urgent cargoes must go through!

For this exacting and vital air transport service are needed the best flyers in the world. That is why ATC assigns only seasoned aviators to its four engine school. And that is why they are trained to become experts in *precision* flying—"post-graduate" pilots on the world's toughest airline routes.

Instrument flying courses and "refreshers" in the Link Trainer are an integral part of this training program. The Air Transport Command, like the airlines, has proved that Link instruction on the ground makes for safety in the air!

SAVES LIVES, TIME, MONEY!

Millions of costly hours of flying time in training planes have been saved by instrument instruction in the Link *on the ground*. Millions of gallons of precious aviation fuel have been conserved for combat missions. And because of instrument flying skill, the lives of many, many of America's sons have been saved.



Link
Aviation Devices, Inc.
BINGHAMTON, NEW YORK, U. S. A.

Over the Himalayan "Hump"—Photo Chinese News Service—Paul Guillumette

LINK MANUFACTURING COMPANY, LTD., GANANOQUE, ONTARIO, CANADA

Makers of Link Trainers, Crew Navigation Trainers and other Devices contributing to the safety of flight

AOPA NEWS

The Aircraft Owners and Pilots Association (AOPA), with National Headquarters Office located in the Carpenters Bldg., Washington 1, D. C., is a non-profit organization composed exclusively of pilots. It looks after the pilot's best interests in all phases of aviation and helps individual pilots with their individual problems. The AOPA operates with a full-time professional staff and is the largest group of civilian pilots in the world. This column is edited by the Aircraft Owners and Pilots Association and opinions contained in it are not necessarily those of FLYING. A special bulletin is sent each month to all registered AOPA pilots and also confidential newsletters from AOPA's Washington staff are sent members from time to time.

COMPLAINT BRINGS RESULTS

Since last month, when AOPA voiced non-scheduled pilots' objections to certain harmful and unethical practices of a small number of fixed-base operators, the mail man has brought in further evidence of this situation.

This matter has been referred to spokesmen for fixed-base operators who acknowledge the need for some "self policing." AOPA believes that greater use of the airport report form by AOPA pilots will assist in bringing about corrective action since an accurate check can thus be obtained. AOPA pilots not already using the "AOPA Pilot Report on Airport Conditions" are urged to write headquarters for a supply.

NEW RULES FOR PILOTS

Effective July 1, new Civil Air Regulations Parts 20, 43, and 60 will go into effect. These are a step in the direction of the simplified regulations for which AOPA has campaigned. The exams for private pilot licenses have been greatly simplified and a more sensible set of air traffic rules has been agreed upon. Contact flight rules have been greatly condensed; instrument flight rules continue to be complex, however. AOPA believes that the new regulations, although an improvement, can be further reduced in number and simplified as to their requirements and their language.

AOPA also recognizes that present revisions will in some measure determine the future possibilities of further reductions and simplification. The manner in which pilots co-operate under the new regulations is important as greater responsibility is delegated to the pilot. The question is, will pilots prove they can fly safely and with good judgment without regulations? That question can be answered by pilots during the next few months under the new rules. It is a challenge to the non-scheduled pilot. AOPA believes most of them will exercise mature judgment and thereby demonstrate that further relaxations are justified.

MANUFACTURERS ON THE SPOT

Will manufacturers of personal aircraft build safer airplanes? If there is any compromise answer to this question, non-scheduled aviation's future is indeed in need of some new blood. In a review of post-war aircraft prototypes AOPA has noted no significantly large amount of attention being given to safety features. On the contrary, the same old danger spots are reappearing; many pre-war models slightly enlarged with prettier paint and a new gadget or two.

This isn't the answer. Where is the vision and planning? If manufacturers are aware of our needs they should feature more safety devices in their samples of post-war aircraft. AOPA's extensive surveys of consumer desires leave no doubt as to what *pilots* want. Investigation into aeronautical research achievements shows that new designs and techniques are available. Why then do manufacturers avoid these factors in planning their new personal aircraft?

AOPA feels very strongly that a much closer link between consumer and manufacturer is needed and AOPA's staff has planned a series of steps to be announced shortly, designed to bring about consideration of certain minimum safety standards in design of personal aircraft.

FLYING RESTRICTIONS

A recent informal poll conducted by AOPA reveals a consensus among experienced Washington observers that the present wartime flying restrictions placed upon civil aircraft operating within the Eastern Air Defense Zone may be lifted concurrent with or shortly after V-E Day. The situation within the Western Air Defense Zone remains doubtful, however, due to the expected increase of military activities in the coastal area. Our prediction is, therefore, that complete lifting of West Coast bans will have to await completion of the Pacific war.

AIRPORT SEPARATION

Airhaven and airpark planning has hit another snag on the matter of separation. Since airhavens, to be useful, *must* be located with or adjacent to popular centers and recreational points, it becomes apparent that special immunity must be declared for this class of landing facility in respect to existing CAA airport separation guides. Otherwise few desirable sites for airparks and airhavens will be approved, since, more often than not, they will fail to pass the rigid requirements of the CAA separation rule.

AOPA has requested that applications for airhavens be given special consideration insofar as airport separation policy is concerned. There is no reason why such personal aircraft landing areas should not be placed at close intervals to serve various communities and subdivisions adequately.

PARTS FOR SURPLUS AIRCRAFT

AOPA officials have requested the War Production Board to expedite formulation of policies and procedures for release of excess spare parts for aircraft and aircraft engines sold to pilots under the present surplus aircraft disposal procedures. In attempting to cut through the endless red tape and continued WPB delays, AOPA officials pointed out that many newly purchased surplus aircraft require parts to make them flyable and airworthy.

Large reservoirs of parts (declared excess by the military) lie collecting dust while owners meanwhile pay storage charges on aircraft grounded for need of these same parts. AOPA asks for immediate steps to cut corners on time-wasting paper work so that these aircraft may be put on the flying line. If such does not come to pass, AOPA has pointed out, the Government may find it increasingly difficult to dispose of surplus aircraft.

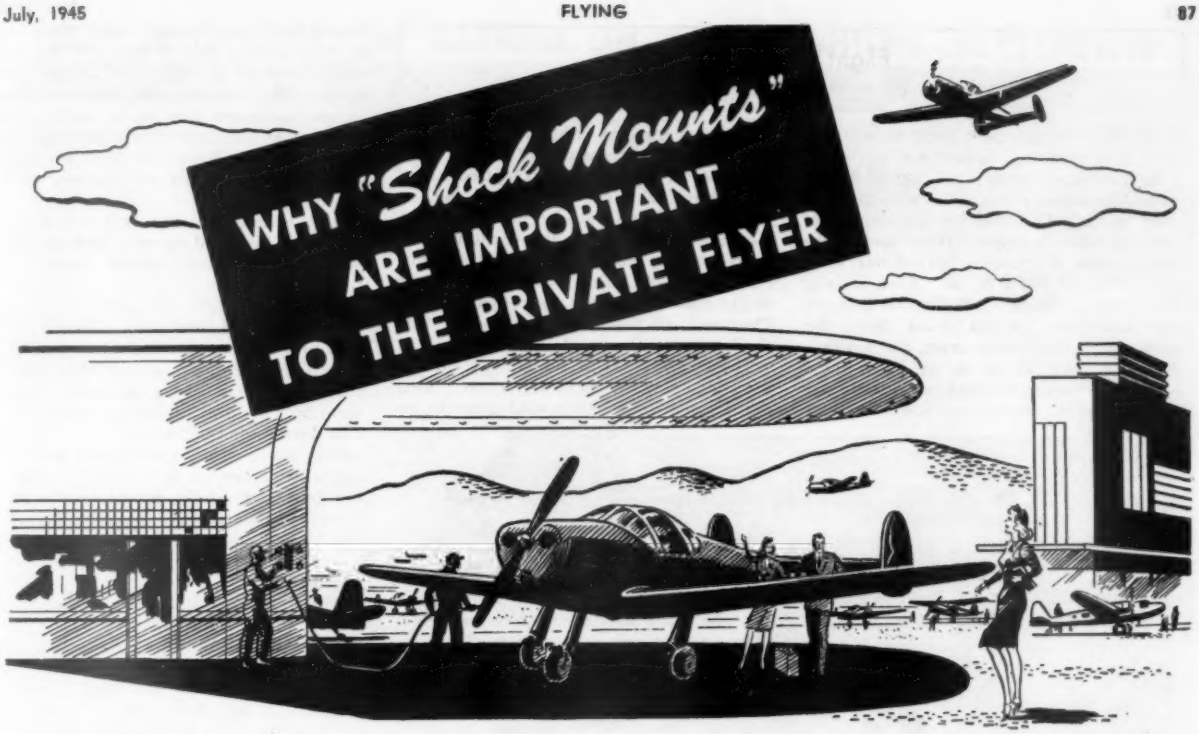
NEW AIRWAY INTERPRETATION

New CAR rules, formerly applied to all airways because they were airways, will not now apply unless specifically designated as control areas. This change is believed by many to be an indication of a CAA and CAB over-all change in policy which recognizes that traffic control, previously limited to airways and airport traffic control areas, in the future will be extended to off-airway areas. By fixing the new regulations to "control areas" rather than airways, traffic control will remain undisturbed when and if CAA decides that airways as such are outmoded. Thus, CAA will be able to move into a position of controlling air space universally, whereas at present such control is generally limited to the air space within the confines of civil airways.

SWIVEL LANDING GEAR PROJECT

John Geisse, assistant to the CAA administrator, has announced that the CAA will begin experiments with various types of swivelled landing gears about July 1. Congress has approved a $175,000 allocation for the development of cross-wind landing gear and study of radar for civilian aircraft. This has pegged the CAA budget for technical development and research to $800,000.

Development of a landing gear suitable for cross-wind landings might save almost $500,000,000 yearly in the proposed Federal airport construction program, since lightplanes with the swivel gear would require only one landing strip instead of two. Stout Research Division of Consolidated-Vultee and Piper Aircraft are working with the CAA in solving problems connected with the installation of such a landing gear on lightplanes. Engineering Research Corporation, the designers of the *Ercoupe*, the non-spin, two-control airplane, may also enter into the research project. END



First, they affect his safety and ease of mind while flying. Because radio or flight instruments, poorly shock mounted, may fail at an inopportune time, due to excess vibration.

A well-designed mount will prevent this.

Second, they affect the private flyer's maintenance budget. Repairs and adjustments of radio and instruments are the expensive result of invisible, but continuous, vibration.

An efficient mount will radically reduce maintenance expense.

The Robinson Vibrashock* suspension, based on an entirely new principle, absorbs better than 90% of engine and propeller impulses from all directions. These suspensions are widely used on our warplanes to protect many different types of airborne equipment.

Robinson Vibrashock suspensions are complete, fully engineered structures, guaranteed to absorb vibration throughout the entire operating range of your airplane.

*Trade Mark

Robinson
AVIATION INC.
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Flight to Poltava

(*Continued from page 25*)

re-tilling their scorched earth to wave at the "Americansky" formations.

Everywhere farms and small towns were blackened ruins. We were passing over country that had known war in its most terrible aspects. Here and there huge banks of cumulus barred our way; we DR'd and DR'd again. Then at last, after some 11 hours of flight, our Russian base rose from the vast plains. Since the steel-mat runway was short, the tower—hardly a tower at all, as we know them—decided we should land last despite our wounded pilot, because we had no brakes.

AAF troops eat and lounge near their tents at an American shuttle bomber base in Russia.

At last everyone else got down and we circled over the war-blasted town of Poltava and came to land. I stood behind the pilot, my arms across his chest, as Jack Knight, our co-pilot, dragged her in, killing every possible bit of speed as we hit nicely on the near end of the runway. In spite of the morphine, Hooper helped out. The runway looked all too short and the tent area too near, but as we ran out of runway we ran out of speed and with relief we ground-looped gently and taxied, awkwardly without brakes, into a parking position.

As we lowered Hooper out of the escape hatch an ambulance drove up and just then the Russia antiaircraft opened up around the field. We looked up and far overhead was a German recco plane. This was no rest camp; that was sure.

We were interrogated in the open on the cement floor of a ruined building. Then we were assigned tents and started to settle down. The base was a big one with somewhat crude facilities. There was a large complement of American ground crewmen with Russian helpers, KP's and guards. The KP's were all girls, built to operate at either end of a plow but they were bright and pleasant. They didn't know any English except odds and ends they had picked up. One day, on the outdoor mess-line, I remarked to the man ahead of me that the C-ration stew looked pretty good, whereupon the girl KP added, "You ain't just a-woofin' (she really said something excretory), bud!" That was all the American speech that she knew.

These girls lived in old railway cars on a siding. Nobody bothered them. One day I came upon one breaking up boxes by smashing them on the ground with one hand. She gave me a big smile and it suddenly occured to me that she might play pattycake with her boy friends like they were boxes. I walked away.

We were just about getting to sleep that night when somebody began to bang furiously on pans. Somebody else hollered, "Air Raid!" We never paid much attention to alerts in England so there were a few cries of "Blow it out!" and "Go away, lemme sleep!" Then bombs began to strike and we all got serious in a hurry. I jumped into my shoes and trench coat, picked up my flak helmet and looked out. Big white flares were drifting down. Searchlights crisscrossed the dark sky and streams of tracers spouted up all around us. I hesitated—not sure whether to see if any detail was being formed to go out on the field, go to the hospital to see about Hooper, or seek shelter. Several sticks of bombs made up my mind for me.

I ran out into a field beside the tents. The slit trenches were bulging so I lay down beside a small mound of dirt and watched the raid. Although the Russian antiaircraft was going strong they had nothing heavier than 40-mm. and the Germans seemed to stay just above their range. The bombing was vicious and accurate; not more than six or seven sticks fell outside the runway and parking area. For most of us it was our first plastering on the ground and we were pretty scared but not panicky.

At the height of the raid a wag near me stuck his head up and with newspaper-headline accents, asked, "Vere is der *Luftwaffe?*"

It was the biggest and most terrible fireworks show I'd ever seen. Bombs were splashing in great bursts across the field; searchlights groped; orange flak tracers streamed up in every direction; planes were burning and exploding; ammunition and flares going off; black smoke drifting across the field, red underneath and glaring white from the flares above. One of our boys hid snugly beside a big pile of boxes. When daylight came he stretched and looked around. He almost took a dive again for the boxes were all brand new bombs.

The raid ended a little while before dawn. No German planes were shot down over the field. As it grew light we looked out over a scene of sickening destruction. Many of our *Forts* that had floated so beautifully in their tight formations against the giant Russian cloudscape the day before were blasted wrecks—some of them nothing but tails. The Germans had sowed the field heavily with butterfly bombs and small aerial land mines so we couldn't go out to our planes until Russian demolition squads had cleared the field. They started on the steel-mat runway, now tangled in fantastic shapes, and all day explosions boomed and pieces of shrapnel whined overhead.

All of us found ourselves respecting the Russians for their courage just as we had liked them for their friendliness. During the raid a detail of 96 Russian soldiers, men and women, went onto the field and tried to save burning *Fortresses* with hand extinguishers—a brave but futile gesture. All 96 were killed.

Behind where I lay in the field a flak battery "manned" by six girls stood up under the bombing, firing steadily until a heavy bomb hit their gun directly. Next morning a huge crater with a hand and a few bits of flesh in it was all that remained.

That night the German radio announced the raid and told us they would be back for the tent area. Meanwhile, however, we were folding our cots and moving in trucks out to a wood a few miles away where we bivouacked and caught up a little on our sleep in spite of a light rain that fell toward morning. The next day we had a look at our plane. From a distance it seemed all right but when we came close we saw it was riddled with shrapnel, a salvage job.

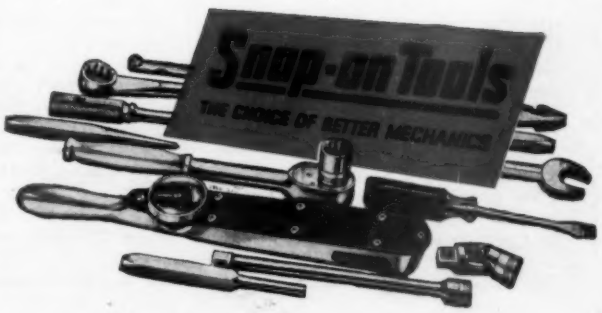
The next morning we hopped into trucks and left for Mirgorod where we were to help load bombs. The groups landing at Mirgorod had managed to move their planes before the attack there and so saved most of them. Our trucks were all American; almost all the trucks we saw in Russia were Lend-Lease. Our Russian drivers loved to race and blow

FOUR NUTS SNAP THE HARNESS ON 2,000 FIGHTING HORSEPOWER

For the Critical Jobs Snap-on Tools

Sweeping the stratosphere at better than 400 mile speed — screaming earthward in bomb dives — blasting tanks, locomotives, fuel dumps in low level strafing . . . Republic's deadly Thunderbolt handles diverse tactical assignments superbly well. The Thunderbolt is super-powered, heavily armed and armored . . . and its mighty engine is anchored with just four one-inch bolts. In this photograph a Republic worker tightens to solid security one of the four vital nuts . . . and does it easily, safely, swiftly . . . with the *right tool* for the job . . . a Snap-on heavy duty ratchet wrench.

Throughout America's greatest aviation plants Snap-on tools play an important part . . . dependable aids to fast, accurate workmanship in every phase of production, assembly, maintenance. Snap-on direct-to-user tool service is available through 38 branch warehouses located in key production centers. Write for 1945 catalog, and address of the nearest branch.



SNAP-ON TOOLS CORPORATION
8024-G 28TH AVENUE KENOSHA, WISCONSIN

the horn. The road was supposed to be a big highway but it was plenty rough. The 110 kilometers [about 69 miles] took us five hours. All along the way people were rebuilding their houses and working on the first wheat crop since the Germans had been swept out of the Ukraine. Most of the people we saw were old, crippled or very young. There weren't many pretty girls; the Germans had taken them with them.

Everywhere along the road people recognized the "Americanskys" and waved enthusiastically. Nowhere in Europe or North Africa have I felt the liking and admiration that Russians extend to Americans. I have yet to meet a more likable people. Wherever we went smiles and enthusiastic greetings met us and a friendliness that had nothing of politics in it.

At Mirgorod we stayed in a big school building converted into a barrack. The Germans had lived in the same building and they reminded us of this in nightly radio threats of further bombings. None came, however.

While surveying routes for a possible emergency two-mile sprint out of town, my co-pilot, another co-pilot named Young, and I struck up a conversation of sorts with some guards at a Russian motor pool. In a few minutes three Russian panzer officers came along and in no uncertain terms racked back the guards for inattention to duty. This formality attended to, officers and men joined in the conversation, accepted cigarets and became friends all around. Shortly we found ourselves in the officers' billet, a low-ceilinged, candle-lit house. A bottle of vodka appeared and after the first shot I decided that Kentucky moonshine was sissy stuff.

My co-pilot, later our first pilot, was a solid boy in all respects but as a would-be student at Yale Divinity School he naturally found little time, or taste, for hard spirits. He sniffed at his and I had to put it away as well as my own but the Russians noticed it and took an hour of tangled talk and gestures to explain why. Their idea of a pilot is a flying sandhog who drinks straight anti-freeze to steady him for combat. The next day Young and I sold our throats and heads to a local merchant who handled furs and bells.

Almost all the buildings in Poltava were unoccupied—burned, bombed or mined. The park had a monument in its center and the usual park business went on—boy eyes girl, and go on from there—just like in America.

Everything from old locks to old cows was sold in the market place there. American cigarets were great trading items and were worth up to 60 rubles a pack. Soap was about the same but there was almost nothing we could buy although we all tried to get some money for souvenirs. I got some brand new money that evidently had been cached in a stable. A woman photographer with equipment of a sort usually found in public parks in America wanted to take our picture. We thought she wanted three rubles or 60 cents but actually she wanted 300 rubles or $60 for a dime portrait. She was highly insulted when, after all the conversation, we said no; but the crowd that had gathered thought it was very funny.

Mirgorod was full of Russian wounded. Their hospitals weren't as good as ours generally but the doctors and operating equipment were. When you see a few of their hospitals you get a better slant on their huge casualty figures which read so matter-of-factly in print.

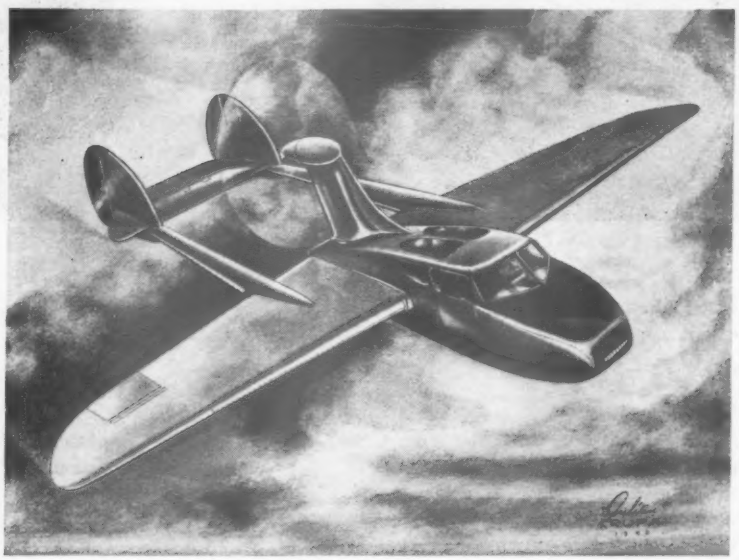
The Russian guards, when changing men on posts, always fired the rifle to see if it worked, a disconcerting habit if you happened to be close. They were trigger-happy in a serious way. If they called "Shtoy!" (stop) and you didn't freeze, they'd fire immediately. My bombardier was almost drilled that way in Mirgorod, but then bombardiers don't pick up languages very easily.

After 10 days our turn came to leave and we took off in a *Skytrain* for Rostov on the sea of Azov at the mouth of the Don. The *Skytrain* had an American crew but a Russian navigator. This is true of all ATC planes operating into or out of Russia. I tried my smoothest but the navigator wouldn't give me one of his log forms. He spent most of his time flying the plane and while his dead reckoning was very loose his pilotage was letter-perfect. His maps were better than the ones we had of Russia. There was no evidence that he ever used celestial—he just knew the route.

At Rostov we stayed overnight at the Russian base. They gave us quarters in a sort of apartment house badly beaten in the war but fixed up. The cots were iron, narrow and close together; some had to sleep on straw ticks on the floor. Women orderlies made us wonder humorously what sort of house we were in.

We weren't allowed in town but a bunch of soldiers—men and girls—entertained us royally. This included a Russo-American volleyball game in which they outclassed us but threw the game for hospitality's sake. Later they played and sang Russian songs for us under a cool moon, and we reciprocated with a few barroom ballads. It is a wonderful thing in Russia to hear their soldiers sing on the march or in their barracks. The depth and harmony of their voices and the strange sadness of their songs are unforgettable.

The next morning we rounded up the hangover victims and left for Teheran. The trip to our home base in England via Teheran, Cairo, Tripolitania and Casablanca extended over 8,000 miles and produced a whole book of experiences in itself. Back in the tight little isle we got a new airplane and went right back to our knittin'. My pilot went to the hospital in Teheran and got back to the states well before us. END



DREAM PLANE

HIGH-PERFORMANCE, low landing speed design for two-place pusher-type monoplane proposed by Vernon W. Payne, chief engineer, manufacturing division, Robertson Aircraft Corporation, could use either a 130-h.p. or 165-h.p. engine. Gross weight with 130-h.p. engine would be 1,300 pounds, top speed 155 m.p.h. With 165-h.p. engine, weight would be 1,500 pounds, top speed 190 m.p.h.

The power plant is enclosed in aft lower part of fuselage, with air duct in nose of fuselage which has shutter control. Propeller is driven by shaft and worm gear. Landing speed with full span flaps and slots, with special ailerons similar to those used on *Black Widow*, would be 28 m.p.h. for 130-h.p. model, 33 m.p.h. with 165 h.p. Wing area is 111 square feet; overall length 22½ feet, span 32 feet.

"You're an Angel...*with wings!*"

Ambulances fly in this war, and their flight brings swift evacuation of the wounded from the areas of front line danger. And because ambulances fly, the wounded are minutes, not days, from the clean sterile mercy of base hospitals.

Flying ambulances lend wings to the skills of doctors and nurses. For doctors and nurses and medical equipment go with the wounded in these hospital wards of the air. The skill of aeronautical engineers and medical science have thus combined to save lives and bring swift mercy.

Fairchild ingenuity, for example, gave the Army Air Forces the "Packet"—a plane in which men and machines can be carried into battle. But the "Packet" is a ship of mercy too, convertible *in a few minutes* to a plane ready to receive the victims of enemy action.

Known to the Army as the C-82, the long-range "Packet" can carry 34 litter cases, four attendants, and medical supplies. Cramped quarters do not hamper nurses ministering to the wounded. An ingenious litter suspension affords ample room for movement. So successful is this strap-suspension device, developed by Fairchild engineers, that it has become standard equipment on all types of planes used as flying hospitals.

Versatile in its applications, the "Packet" can do double duty as a mercy ship. It can carry the wounded from front line evacuation fields over long distances to base hospitals. Returning to the forward areas, it can carry up to *nine tons* of supplies needed at the front lines.

Fairchild Aircraft

Division of Fairchild Engine & Airplane Corporation, Hagerstown, Maryland

THE ARMY NEEDS NURSES
—JOIN NOW!

Prodigious L-K Creation Carries Army "Payload" of More Than Six Tons!

Largest U. S. Cargo Glider Now In Production At Laister-Kauffmann Where It Was Designed and Built

ST. LOUIS—The new Laister-Kauffmann sky-giant CG-10A may prove to be the most significant aeronautical development of World War II.

Submitted to unprecedented, gruelling tests because of both its size and its revolutionary all-wood construction, the Trojan Horse took them all in stride.

The Trojan Horse is the first satisfactory rear-loading aircraft ever developed for the U. S. Army Air Force. Landed and ready to unload, the two clamshell doors are opened by one man in less than five seconds. Mobile equipment is driven out of the plane—as it was driven in—on a
opens autom
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is only 20 i
ground.

wheel army truck; or 42 fully armed men.

The Trojan Horse descends fully loaded at steep angles of glide with practically no increase in forward speed, enabling it to land in small clearances unreachable with powered planes. This will give the Trojan Horse a tremendous advantage in peacetime cargo hauling too.

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rojan Horse, is able to
strike behind enemy lines
with fearful, unpredicta-
ble certainty of lightning.
To our land forces it will
bring power—tremen-
dous new fighting power
—*from the air.*

time
ield static tests
successfully.

In the event of a crash landing, the out-swinging doors in the rear assure positive and immediate unloading—of several jeeps; or a 2½ ton, 10-

Trojan Horse

Laister-Kauffmann Aircraft Corporation
ST. LOUIS (2) MISSOURI

Forgotten Pioneer

(*Continued from page 57*)

tion and he did it in his own way.

His first move was to set up a shop where a pilot could buy things cheaply. That was an innovation. In most branches of aviation it would still be an innovation today. Then, in Chicago, where automobile manufacturers were just tasting the fruits of popularity, he established the Heath Aeroplane Company.

It was not an airplane company as such. It was a parts and materials store. He made and sold wing "dope" by the barrel. He made propellers. He built wings to any shape, any size. He sold wire, cables, turnbuckles, wing and fuselage fittings, radiators, fuel tanks, wheels, new and rebuilt engines. He never turned down an order. If he didn't have the thing on hand, he either made it or bird-dogged around until he found it. The Heath Aeroplane Company was aviation's first trading post.

By 1914 Heath had built another plane, a biplane with a 33-foot span and equipped with pontoons. It flew all right. Chicagoans strolling along the shores of Lake Michigan saw little Ed Heath, a veteran designer at the age of 25, manipulating his flying contraption out over the water.

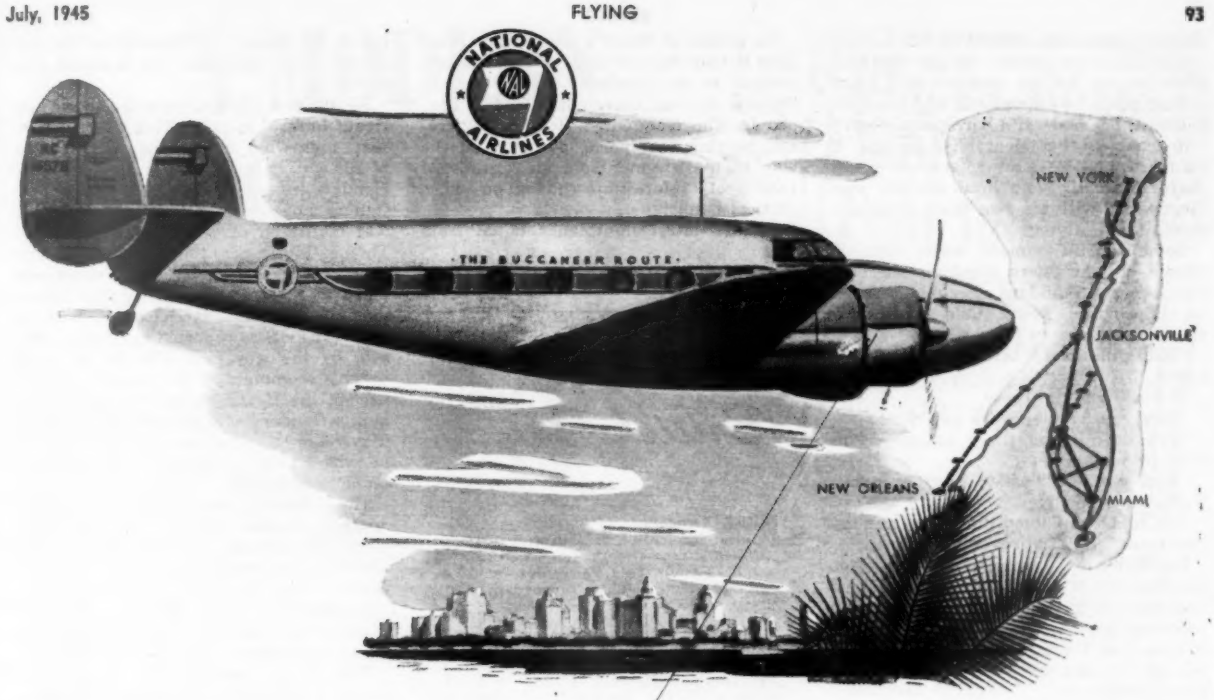
The war didn't do badly by the Heath business. His stock in trade was propellers but he sold other small-plane parts in the hundreds and thousands. And now he introduced another basic business tenet. He had a number of employes, most of them young men.

"The only way you can learn," he would tell them, "is by doing." Their apprenticeship was informal but real. They learned. They flew. When Ed Heath got through with them they were pretty good pilots. Meantime Heath himself talked lightplanes. What was needed, he said, was a flying machine cheap enough for the average man to buy. Everything in aviation was too expensive.

His first lightplane production model was built in 1918. Suitably enough, he called it the *Feather*. It was powered by a seven-h.p. Thor motorcycle engine—and it flew. For a self-educated aeronautical engineer Heath was making history. He didn't do things by halves. He tinkered with that seven-h.p. engine, for example, until he had lightened it to his satisfaction. He designed a special propeller for maximum thrust. He put engine and propeller on a test stand until he was sure of the power plant's reliability. After that he began designing the plane.

That was a Heath peculiarity. He always designed his planes around a given engine.

The plane turned out to be a single-seater with a span of 20 feet. It weighed 270 pounds empty and had a top speed of 45 m.p.h. Heath wanted to manufacture it in quantity but something he had not foreseen happened. The war over, the Government began unloading airplane surpluses on the public. He could manufacture airplanes cheaply but not cheaply enough to compete with the prices at which wartime Standards and



FROM THE SKYWAYS OF THE WORLD . . .

BETTER SPARK PLUGS FOR YOUR PLANE

Champion Ceramic Aircraft Spark Plugs are used exclusively by National Airlines because "they are dependable, efficient and completely satisfactory." Operating its fleet of Lockheed Lodestars from New York through to the Southeastern Atlantic and Gulf states, National has compiled an enviable record for speed and service carrying vital war cargoes and priority passengers on unusually fast schedules. They strongly emphasize maintenance to insure dependability.

Thus once again the prestige and efficiency of Champion Spark Plugs for every aircraft engine is confirmed by their use by a leading airline—just as it has been so dramatically demonstrated in the most powerful bombers and combat planes. The Champions you buy for your present plane are products of the same research, basic materials, engineering and precision manufacture. Naturally they will insure an extra measure of performance, economy and dependability. Use Champions and fly with confidence. Champion Spark Plug Company, Toledo 1, Ohio.

DEPENDABLE

CHAMPION SPARK PLUGS

BUY BONDS — "BIGGER BONDS FOR THE MIGHTY SEVENTH"

Jennies were being offered on the market.

But Heath was smart. He put his lightplane on ice for the moment and began selling parts for Standards and *Jennies*. Business boomed. If a barnstormer's guy wire snapped, he telegraphed Heath. If he telescoped his landing gear in a cow pasture, Heath sent him another one. Meanwhile, with his own stock of planes, Heath taught flying.

Some fanciful stories were told. A couple of youngsters climbing out of a Heath-owned Standard after a landing on an improvised flying field were surrounded by curious farm people.

"Who's the pilot?" one of the flyers was asked.

"I am," was the reply.

"How much flying have you done?"

"I've been flying three hours." This with pride.

"And who's he?" asked a farmer, pointing to the other flyer.

"Oh him," explained the pilot, "he's my instructor. He's got seven hours."

Incredible as it sounds, it wasn't too far from the truth. But a Heath-trained man usually knew enough to keep from breaking his neck. It was Heath's contention that if a man was good enough to release for solo, he was good enough to give instruction.

Heath himself polished off his stick-and-rudder technique by taking some aerobatics instruction in 1919 from Roy E. Guthier, a war pilot. He practiced assiduously, using one of his own *Jennies* and, later, a Thomas-Morse *Scout*. When he got through he was an accomplished artist.

Heath got the urge to design a new plane again in 1923. This time he was more ambitious. The crystallization of his idea was the *Favorite*, an aerodynamically clean biplane powered with a 90-h.p. OX-5 engine. With Heath at the controls it carried four persons from Chicago to St. Louis, where it collected prizes for efficiency and won some events in the National Air Races.

Heath prospered and, learning by doing, hundreds of Heath students not only won their wings but became expert airplane and engine mechanics as well. By this time the company had acquired a 160-acre field northwest of Chicago. It boasted no structures. Planes—there always were from 30 to 50 Standards and *Jennies* about—were tied down for the night in the lee of a circular grove of tall trees. Gasoline and oil were dispensed from drums. Water for radiators was hauled in by motor trucks.

It's true that Heath turned his students loose after a bare minimum of instruction but he knew that only a fool could get into trouble with a Standard, his favorite training machine. It had a landing speed of 43 m.p.h. and a top of only 63. If a man began developing bad habits in the air, Heath himself would take the student aloft and straighten him out with 30 minutes of instruction.

One student, a dentist, took two hours of instruction, and forthwith hied himself to St. Louis to buy a new airplane. He flew it back, with a trusting friend in the front cockpit. They stepped out at Heath's field with the yawning comment that the trip had been enjoyable.

To critics of Heath's instruction practices it may be said that he never lost a student in an accident. Maybe it was because he was thorough. To this day, people who frequented Heath's field recall hearing that voice, carrying all the way to the ground from an altitude of 1,000 feet, "More top rudder on those vertical banks!"

Heath's latest lightplanes dated from 1925. In that year he and Claire Linsted, a designer whom he employed, produced the *Tomboy*, built around a 32-h.p. Bristol *Cherub*. It was a single-seat, full-cantilever monoplane with a span of about 22 feet. The wing butts attached at the top longerons. Its speed—and remember its horsepower—was 103 m.p.h. Heath used it to win the lightplane events at the National Air Races in Philadelphia the following year. His take for winning was $2,500.

Heath and Linsted produced the first Heath *Parasol* in 1926. This was a single-seat, high-wing monoplane with a span of 26 feet. It was built around a 27-h.p. Henderson motorcycle engine. The designers improvised somewhat—the wing was contrived of two lower wings of a Thomas-Morse *Scout* biplane, braced with steel tubing and cables. The plane was all right. No less an authority than Transport Pilot Thomas E. Nelson of National Air Transport so reported to Heath. Nelson, by the way, was Charles A. Lindbergh's roommate at this period and it is part of the Heath legend that Lindbergh kept a Henderson engine under his bed at Maywood, Ill. The transatlantic flyer-to-be was trying to convert it into an airplane powerplant.

The following year Heath constructed another version of the *Parasol*. This plane was cleaner. It had a 24-foot span and was powered with a *Cherub*. He called it the *Spokane Super-Parasol* and proceeded to annex the light and sport plane events with it at the National Air Races in Spokane. His take: $1,000.

This event marked a turning point; Heath had found his lightplane market—the first big lightplane market in the United States. Again he showed his business sagacity. To those who wanted to fly he preached, "Build your own airplane." He sold blueprints for the *Parasol* by the thousands. Of course, if a customer wanted the plane complete, Heath would sell that too.

It was a good airplane, making 75 m.p.h. at full throttle. For demonstration purposes it would be flown with one man at the controls and another lodged in the wing bracing struts. Of course, the United States Government had not yet put a restraining hand on the home-built airplane. Yet out of the hundreds of *Parasols* constructed in the backyard, records show that only two killed their owners.

The *Baby Bullet* of 1928 was followed in 1929 by a brace of *Super-Parasols* that captured first and second places in a lightplane event at the National Air Races in Cleveland, and Heath provided a change of pace with a 27-h.p. seaplane that performed commendably on Lake Zurich, near Chicago, in 1930.

That same year the Heath *Cannonball*, a bigger version of the *Baby Bullet*, powered with a 110-h.p., four-cylinder Heath-built engine, came in ahead of the field in one event at the National Air Races in Chicago. Foreseeing every phase of public interest in aviation, Heath built a biplane glider. His partisans say he was the first man ever to loop an engineless heavier-than-air craft.

Heath was doing well. His inexpensive little airplanes had caught on. He had proved his point on low cost. His customers were numbered in the thousands. Justifying his faith in the lightplane, other manufacturing companies were entering the field. He decided that a variety of aircraft styles could maintain his place in the market. He would have a parasol type, a mid-wing and a low-wing.

The parasol had proved itself. Now he

the British Say . . .

BELL *Airacobras* (P-39Q-30) are powered by 1,710-h.p. Allison V-1710-85 engines, giving them a top speed of 375 m.p.h. Range is 1,500 miles, service ceiling 16,000 feet. *Airacobra* production totaled 9,000. . . .

The AAF version of the Navy's Consolidated *Privateer* (PB4Y-2) has been designated the B-24N. . . . Range of the Douglas *Invader* (A-26) is 1,522 miles. . . . The Grumman *Bearcat* (F8F) is a new, improved model of the *Wildcat* (F4F). . . .

U. S. Navy designation for the AAF's Sikorsky R-4B helicopter is HNS-1. . . . The U. S. Navy's FT-1 is similar to the P-61B version of the Northrop *Black Widow*. . . . The version of the North American *Mustang* with the extended vertical fin is the P-51E. . . .

It is rumored that a Curtiss *Ascender* (XP-55) once flew from St. Louis to Chicago at an average speed of 537 m.p.h. . . . The Stinson L-12 is the AAF liaison version of the civil *Reliant*. . . . The Boeing XC-108 (probably the transport version of the *Flying Fortress*) recently carried 70 fully-armed infantrymen on a cross-country flight. . . .

The Culver PQ-8 is a radio-controlled target airplane. . . . The old (1932) Lockheed *Orion* is designated UC-85 by the AAF. . . . The old Lockheed *Vega* (also 1932) is the UC-101. . . . A new Navy fighter is the Curtiss XF15C. . . .

—THE AEROPLANE SPOTTER

Latest version of the P-47D has the British gyro gunsight. Top speed of this *Thunderbolt* is 399 m.p.h. at 28,000 feet, rising to 420 m.p.h. higher up. Cruising speed is up to 330 m.p.h. at 28,000 feet. . . . The Douglas *Skymaster* (C-54B) has four 1,450-h.p. engines, cruises at 204 m.p.h. and has a gross weight up to 73,000 pounds. . . .

—AIRCRAFT RECOGNITION

Martin *Baltimores* (A-30) now are in use by the Greek air force for distributing newspapers to islands in the Aegean Sea. . . .

—THE AEROPLANE

A MODERN MISSION OF MERCY

New Bell Helicopter Plays Major Role In Saving Lives of Ice Fishermen Marooned on Lake Erie

Actual Photograph, Taken During Lake Erie Rescue, of the Part Played by the Bell Helicopter

Planes, Boats Join to Save Four in Lake

Helicopter Flies Two To Safety From Ice; Coast Guards Rescue Boy, 11, Grandfather

A Bell Aircraft helicopter,

THE unique qualities of the new Bell helicopter — its ability to do things impossible for any other type of aircraft — have already been dramatically demonstrated in two emergency mercy missions.

Two fishermen marooned on a spring ice floe in Lake Erie were rescued by the versatile aircraft when all other means of reaching them had failed. Earlier, when Western New York was weather-locked by the worst winter in history, the Bell Helicopter carried a doctor to the aid of an injured pilot who had bailed out of his crippled plane and was snow-bound by drifts ten feet high.

These two mercy missions demonstrate one of the helicopter's special capacities. Because it can fly in practically any kind of weather — forwards — backwards — up — down — sideways... hover over a given spot or land on a small plot of ground, the helicopter will also have many other peace-time applications and advantages over other forms of transportation.

At first it may have such specialized uses as rescue work, cargo transport, forest fire patrol, ambulance service, crop dusting, pipe line patrol and other industrial and commercial applications where the most important thing about the helicopter will be its unusual utility.

Right now, Bell Aircraft's interest in the helicopter is primarily in its future development. The production of all our plants is still one hundred percent geared up to a victorious and early ending of the war — building fighter planes at our Niagara Frontier Division, ordnance materials at our Burlington Division, and B-29 Boeing designed Superfortresses at our Georgia Bomber Plant.

A booklet describing the Bell Helicopter will be mailed without obligation. Write the Bell Aircraft Corporation, 2050 Elmwood Avenue, Buffalo 7, New York.

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Flexible Gun Mounts and other ordnance materials

GEORGIA DIVISION
Marietta, Ga.
B-29 Boeing Designed Superfortress

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IN sun-brilliant stratosphere... or cutting an incandescent swath across a glittering sea... dazzling glare can hide enemy activity—and prove a source of deadly danger to unprepared fighting men.

That's why the *glare protection* of Calobar Sun Glasses is vital to our Armed Forces. Calobar lenses are *optically* ground and polished. Their special formulation admits plenty of "seeing" light... while tempering blinding light... and absorbing infra-red (heat) and ultra-violet (sunburn) rays. And their sturdy frames, tops in wearing comfort, provide a full range of vision.

Production of Calobar Sun Glasses today is for Army and Navy aviation personnel only. After the war, they will be available to all, through those who give professional eye care ... and to fliers from airport sources. Your fixed base operator will then be able to supply you.

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World's largest makers of ophthalmic materials

BUY WAR BONDS AND STAMPS

would build the low-wing and then the mid-wing.

On that spring day in 1931 they watched Heath put his new airplane into a wingover. Then the right wing whipped back against the tail of the ship. They saw Heath's tight lips, and they saw the rudder and elevator flail the air fruitlessly, and then they saw the ship hit and crumple up, and a plume of dust rose skyward.

A lot of people attended Heath's funeral. But the little man with the strident voice, the little man who a quarter of a century ago saw the airplane as a medium of personal transportation, merits a greater tribute than that. END

International Plane Markings

(*Continued from page* 49)

identification marks set forth by a convention subcommittee:

1. Nationality and registration marks on planes shall consist of a group of symbols comprising a letter or letters, followed by letters or numbers. The subcommittee gave a choice of using letters or numbers, merely recommending world standardization of symbols.

Noteworthy in the above recommendation is the phrase "followed by letters *or numbers.*" The 1919 International Convention of Air Navigation had made no provision for use of numbers. It provided only for letters. But the subcommittee at the recent Chicago parley took cognizance of the fact that "*efficient identification of aircraft is equally attainable using numbers, as does the United States,* or letters, as is the practice of ICAN signatories." Hence, the American system of using letters followed by numbers—such as NC-1989—may well serve as the model for a worldwide uniform system supplanting the all-letter combination set forth in the ICAN agreement of 25 years ago to which the United States was not a signatory.

2. Nationality and registration marks carried by planes shall consist of a nationality letter or letters, *which may be followed by a symbol denoting the class of airworthiness,* and shall be followed by numbers or letters. The important clause in this provision is that dealing with airworthiness, which, in the United States, is denoted by the "C," "R," and "X" designations as previously explained.

The subcommittee noted in this connection that, if letters are used as registration identification marks, a hyphen shall be placed immediately after the nationality letter or letters and, where it appears, the airworthiness symbol. It added that "each state, party to this convention, which employs airworthiness symbols, shall advise every other state annually of the symbols used by it." While the use of an airworthiness symbol was made optional, the subcommittee recommended a uniform system "(1) as to whether or not aircraft engaged on international air navigation should carry a letter indicating the class of airworthiness certificate issued for them and (2) that, if it is optional for the aircraft of any particular country engaged on international air navigation to carry a mark

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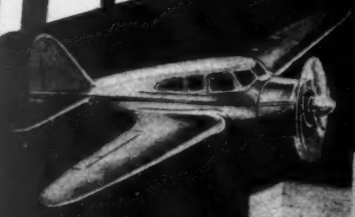

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indicating the type of airworthiness certificate issued for them, the marks used by all countries following such a system should be uniform."

Thus the nations represented at the Chicago parley were urged to use identical airworthiness symbols if they decide to use them at all.

3. Identification markings should be painted "once on the lower surface of the main plane structure and once on the upper surface of the main plane structure" or on top and beneath the wing—as well as on either side of the fuselage or on either side of the tail.

4. The letter or number markings on the wings should be of equal height—four-fifths of the average width of the wing. But the height of the markings need not exceed 40 inches or 100 centimeters. The fuselage or body markings should be "as large as possible without interfering with the visible outlines of the fuselage or body," and they need not exceed 40 inches or 100 centimeters. Tail markings should be on the upper half of the tail surfaces. As for size, they should be "as large as a two-inch or five-centimeter margin will permit and in a position which will give the greatest size."

5. Letters should be in capital letters in Roman characters without ornamentation. If numbers instead of letters are used for identification markings, they should be Arabic numbers without ornamentation. The sub-committee went into minute detail, even to the point of specifying the length of the hyphen and the thickness of the lines forming the letters. It specified that:

"The width of each letter and the length of the hyphen shall be two-thirds of the height of the letters, and the thickness of the lines forming the letters and the hyphen shall be one-sixth of that height. As nearly as the constructional features of the aircraft admit, each letter shall be separated from the letter which immediately precedes or follows it (the hyphen for this purpose being regarded as a letter) by a space equal to half the width of the individual letters. In order to render the marks clearly legible, the lines forming the letters and the hyphen shall be solid and of a uniform color contrasting clearly with the background on which they are placed."

It is clear that the subcommittee left little or nothing to guesswork but virtually applied a slide rule to fix sizes of identification markings.

To make certain that such markings will do the job for which they are designed, it was provided further that they be displayed "to the best possible advantage" and that they "must always be kept clean and visible."

These markings, along with other pertinent information such as a description of the aircraft and the full name, nationality, and residence of the plane owner, should be entered in the register and the certificate of registration, a system similar to that followed in the United States.

Obviously, the key to ready identification of a plane is its nationality code letter or letters. This is the tentative table of nationality marks—letter designations for each country—as submitted to the Chicago convention:

Afghanistan—YA
Australia—VH
Belgium and Belgian Colonies—OO
Bolivia—CB or CP
British Colonies and Protectorates—VP, VQ, VR
Burma—XY
Canada—CF
Chile—CC
China—XT
Colombia—HK
Costa Rica—TI
Cuba—CU
Czechoslovakia—OK
Denmark—OY
Dominican Republic—HI
Ecuador—HC
Egypt—SU
El Salvador—YS
Ethiopa—ET
France and her Colonies and Protectorates (excluding Morocco)—F
Greece—SX
Guatemala—LG
Haiti—HH
Honduras—XH
Iceland—TF
India—VT
Iran—EP
Iraq—YI
Ireland—EI
Lebanon—LR
Liberia—LI
Luxembourg—LX
Mexico—XA or XB
Morocco—CN
Netherlands—PH
Netherlands East Indies—PK
Netherlands West Indies—PJ
Newfoundland—VO
New Hebrides—YJ
New Zealand—ZK
Nicaragua—AN
Norway—LN
Panama—RX
Paraguay—ZP
Peru—OB
Philippines—PI
Poland—SP
Portugal—CS
Portuguese Colonies—CR
Spain—EC
Surinam—PZ
Sweden—SE
Switzerland—HB
Thai—HS
Turkey—TC
Union of South Africa—ZS
United Kingdom—G
United States—N
Uruguay—CX
Venezuela—YV
Yugoslavia—YU

The nationality mark for Syria will be selected at a future date. The subcommittee, noting specifically the case of Thai, said that its recommendation on aircraft nationality marks is "subject to such decisions as may be taken by the appropriate Allied authorities on the political issues which arise in the case of ex-enemy countries." This would appear to apply also to Bulgaria, Finland, Italy and Romania and eventually to Germany and Japan. The subcommittee did not list a nationality mark for Russia, which was not represented at the conference.

In the case of Ethiopia, Lebanon, Liberia and the Philippines, the marks set forth are provisional.

Along with its action on identification markings, the Chicago subcommittee also recommended that the call sign of a plane should be identical, "as far as practicable," with the nationality and registration marks of the aircraft.

It also took into account a current development by including provisions for marking helicopters, gyroplanes and ornithopters—which weren't considered in the 1919 ICAN agreement. The provisions for such craft, insofar as identification markings are concerned, are similar to those applying to airplanes.

Anticipating a vast increase in number of post-war aircraft, an unlimited number of letters or digits for aircraft markings was recommended. The reason for this is apparent when it is noted that under the ICAN agreement providing a maximum of five letters—including the one or two letters designating the country—the maximum number of identifications allowed for a country with a two-letter national symbol was only about 17,000.

At present the United States permits a maximum of five digits after the nationality and airworthiness symbols, thus —NC-46839. Alternative plans being considered by this country to meet identification marking requirements for ex-

(*Continued on page* 102)

ROBOT TARGETS

ROBOT target planes—small, fabric-covered craft with a tiny engine, mounting twin, counter-rotating propellers on the same shaft, are being used as targets by the Panama Coast Artillery Command.

When hit by antiaircraft or machine gun fire, a parachute floats the plane to the ocean's surface. It is then rescued by specially trained seagoing soldiers who man a 16-foot oar-powered "junior crash boat."

Known as "Intoxicated Seagulls" or "Salt Water Ducks," the small planes are lifted from the surf tail-first, draining the sea-water from the fuselage and engine. They are then returned to land, either in the boat itself or, if rough water prevents, towed in. Special Army bases maintain and repair the queer craft, which average 10 flights per plane before being "washed-out," although many are destroyed on their first flight.

Library University of Mo.

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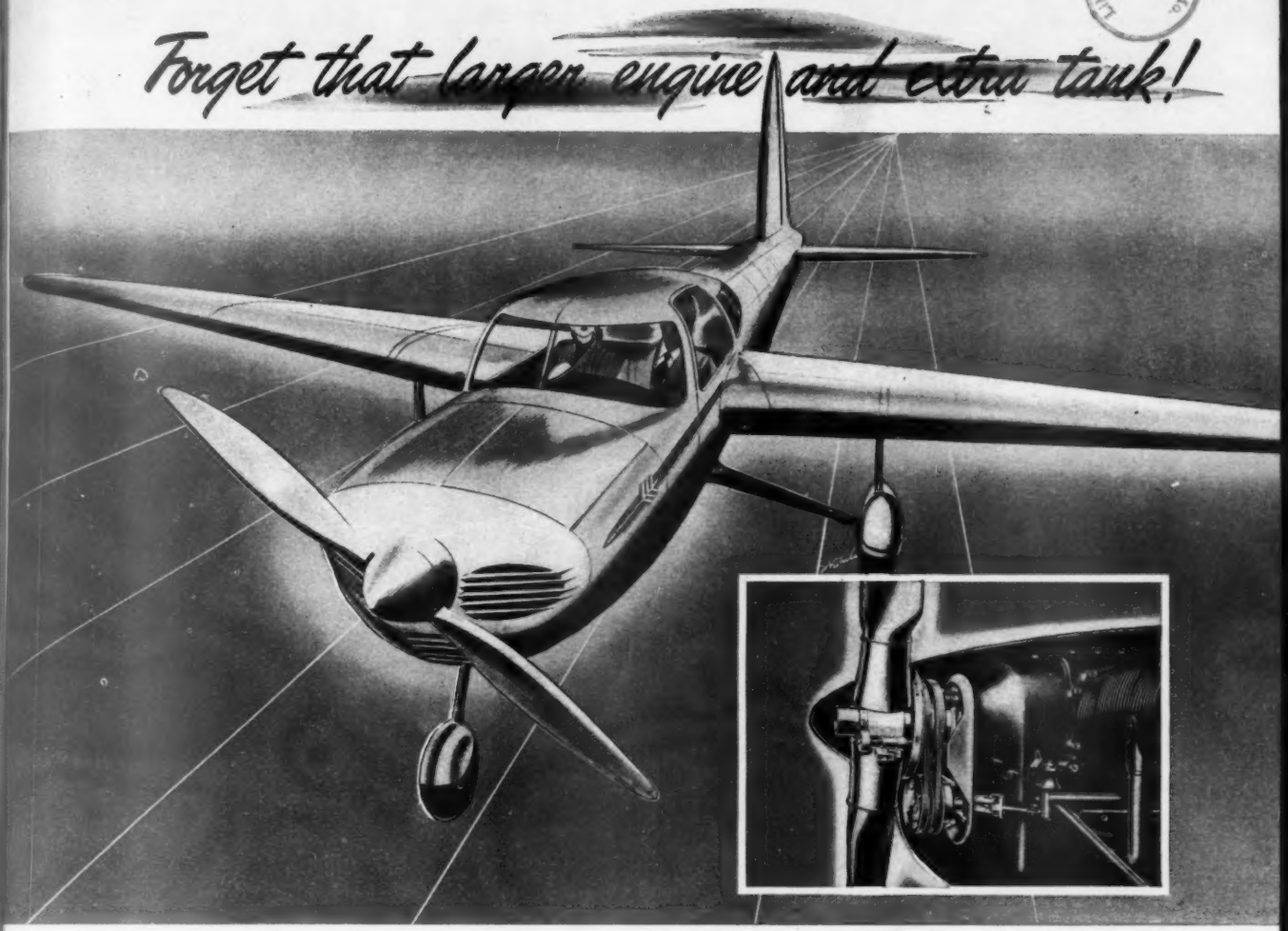

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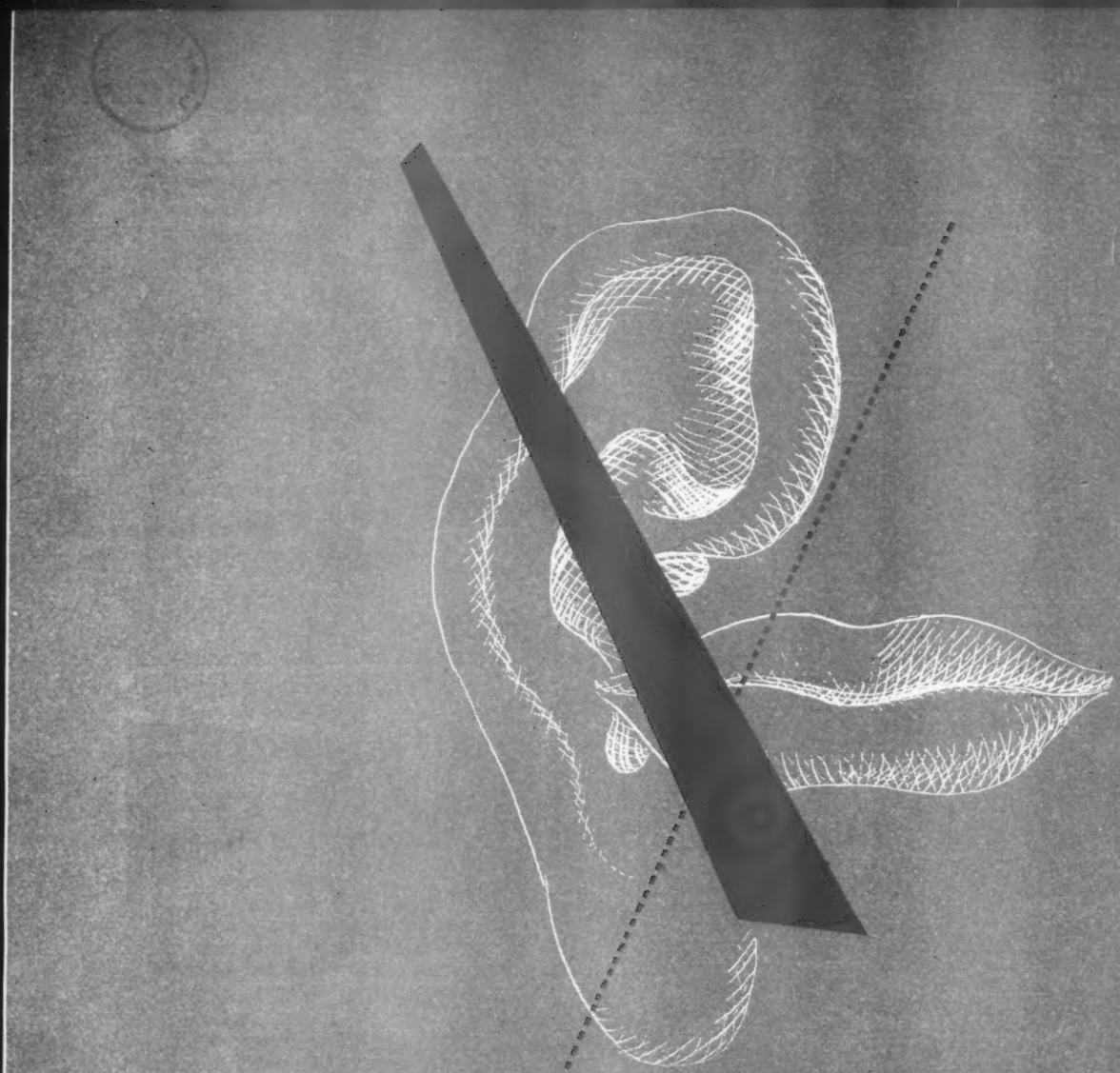
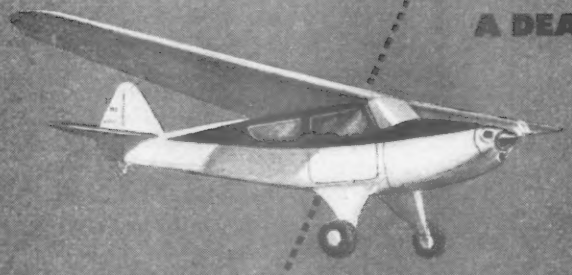


A DEAF AND DUMB AIRPLANE? NEVER!



In the coming age of flight, thousands of new airports and airstrips will dot the landscape... and in the air, thousands of planes will be equipped with many new devices developed by the war's needs.

Post-war planes will offer more efficiency, utility, comfort and safety than ever before, and one of the most important contributing features will be two-way radio communication. A deaf and dumb plane will have no place in tomorrow's crowded airlanes.

AIRADIO'S Two-Way is a triumph of efficiency designed for the most critical pilot. Amazingly light—receiver, transmitter and power supply unit complete, weighs less than 11 pounds.

AIRADIO'S Two-Way provides radio range, weather broadcast, interphone and standard broadcast reception.

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(*Continued from page 98*)

panded post-war aviation include (1) increasing the maximum number of digits to six or (2) retaining the present maximum of five digits, but adding a letter suffix to the numbers.

Whatever the post-war civil aviation expansion in the United States, the CAA and its certificate section are geared to handle the situation from an administrative standpoint.

Mrs. Julia Hevener, assistant chief of the certificate sections reveals that plans already are underway in CAA to meet the problems of the anticipated expansion.

Mrs. Hevener is a veteran with the CAA, having joined it the same week that Charles A. Lindbergh made his historic New York-to-Paris flight in May, 1927. In her nearly 18 years with CAA, she has always been with the certificate section, serving originally as chief clerk and then being promoted in 1929 to the post of acting chief of the entire section.

It is her job to see that the Government has complete records of the issuance of all certificates for airmen—pilots, ground mechanics, dispatchers, parachute technicians, control tower operators—and all civil aircraft. She oversees what amounts to a Hall of Records of American aviation.

If you want to know whether there has been a reassignment of the famed number NX-211, which identified Lindbergh's history-making monoplane, *The Spirit of St. Louis*, she has the answer at her fingertips. She can give you the history of the magic number "211." After *The Spirit of St. Louis* was retired to the Smithsonian Institution, number 211—which then became NR-211—was assigned to Lindbergh for a Lockheed which now is in the American Museum of Natural History in New York City. Lindbergh again was given NR-211 for a plane with which he conducted inspection and survey work. But 211 has since reverted to the CAA for use on one of its own planes.

The CAA has reserved numbers 1 to 500 for its own planes. If these numbers were assigned to private planes before CAA reserved them, the agency permits the original holder to keep the number but requests him to add a letter suffix to the number and CAA takes the number alone.

What has happened to other famous numbers? Remember the NR-105W which identified the late Wiley Post's *Winnie Mae*, the durable Lockheed *Vega* which girdled the globe in eight days back in 1931? That number never has been reassigned. Neither has NX-4204, which identified Amelia Earhart's *Friendship*—the doughty craft that carried her across the Atlantic in 1927.

Also never reassigned were NC-4453, the number of the Fokker in which Rear Adm. Richard E. Byrd flew over the Antarctic; the NR-7955 which identified the late Capt. Frank Hawks' Lockheed *Air Express*, in which he streaked to a then breath-taking transcontinental speed record June 27, 1929, and the NX-3789 which marked the Bellanca monoplane *Pathfinder* in which Capt. Lewis A. Yancey and Roger Q. Williams sped from Old Orchard, Me., to Rome—via Spain—in July, 1929.

Like Lindbergh's 211, some other famous numbers have, however, been reassigned. Remember when Ruth Elder and Capt. George Haldeman took off on a transatlantic flight in October, 1927, aboard the Stinson monoplane *American Girl*? Miss Elder's ill-fated craft (it was forced down 350 miles from the Azores and both Miss Elder and Haldeman were rescued) carried the number NX-1384. That number since was reassigned to the Seversky Aircraft Corp., for an experimental plane.

The NR-206 on the Fokker *America*, in which Byrd, Acosta, Balchen and Noville flew from New York to France in 1927, also has a new owner. It was reassigned to the St. Louis Aircraft Co. for an Avro plane.

Then there was NR-237. Aviation enthusiasts will remember it as the number painted on the Wright-Bellanca *Columbia*, in which Clarence Chamberlin flew from New York to Germany in 42 hr. 45 min. on June 4-6, 1927. That famed number has come home—to the CAA, where all American private and commercial plane numbers are born, grouped and distributed. NR-237 now identifies a CAA plane. END

Bomber Bait

(*Continued from page 55*)

Personnel activity is indicated by simulating bivouac areas, usually on the edges of tree clumps, with a dummy tent or two peeking out innocently for aerial observation.

Ack-ack emplacements follow. Knowing that photo interpretation officers read tracks like Sioux Indians, the engineers run a couple of trucks out into a clear area, leaving tire tracks in a distinctive pattern that means "ack-ack" to a PI man. Deception may be employed to the extent of constructing revetments and log guns but the over-obvious is avoided. Roads can be simulated in minutes by dragging a heavy log behind a truck. When trucks bearing folded-up dummy aircraft arrive, the fake strip begins to get its most realistic touches. Three or four bona fide planes may be flown in to taxi around and take off for effect.

To complete the whole ersatz picture, radio traffic begins to hum at the strip in a manner that provokes knowing nods from listening enemy monitors. As a matter of fact, radio traffic alone can be used to simulate a hidden air strip.

While this procedure may seem like an extensive operation, in reality it requires only a fraction of the time and effort that go into building a real strip.

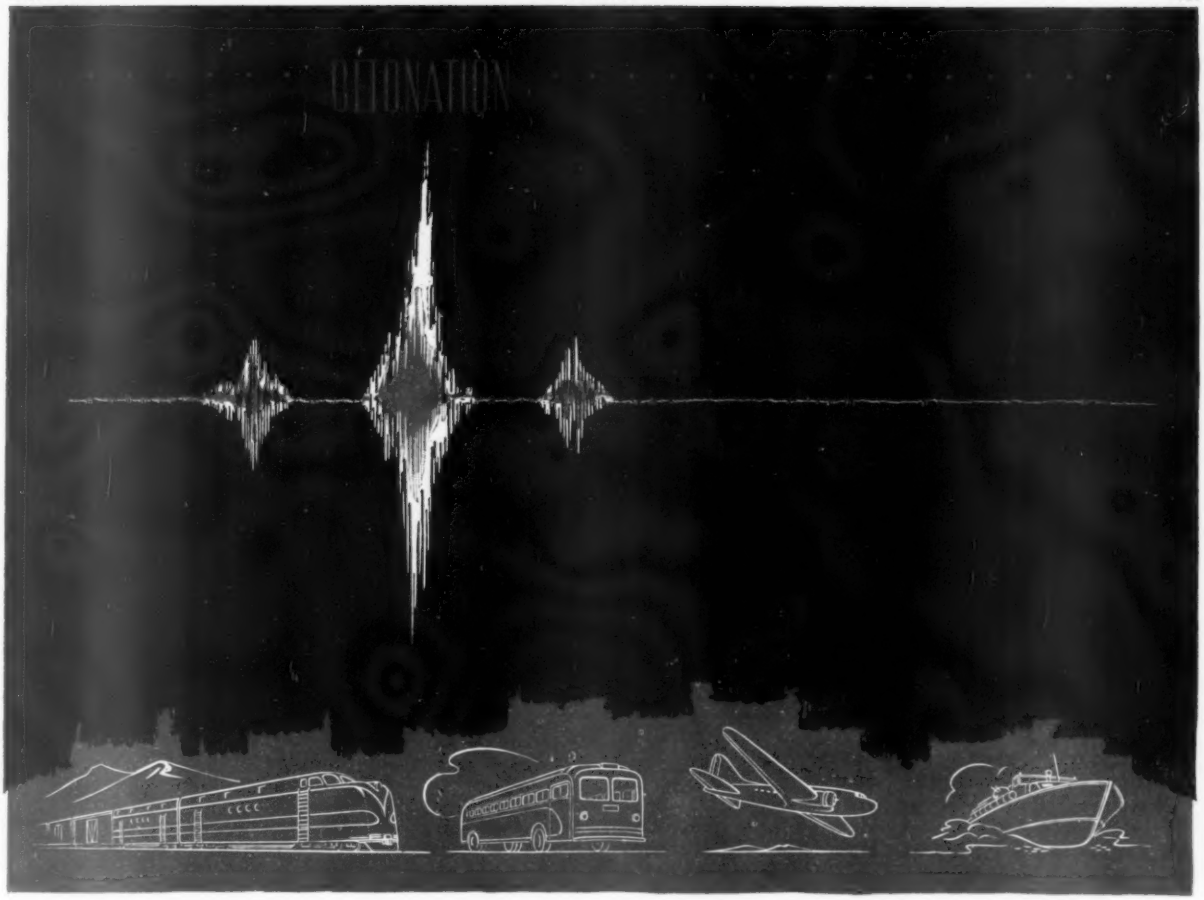
There is one major difference between the German and Japanese employment of dummy aircraft and our own. With the enemy, dummies, camouflage, almost every type of deceptive effect, is primarily construed as a defensive weapon. Americans see deception as an offensive measure.

Illustrating this difference is the fact that on some occasions the Japs and Germans have set up their dummies with no other purpose than to lure our bombs. American engineers and intelligence officers recognize in dummy installations opportunities to confuse enemy intelligence—to make them guess wrongly as to the disposition of our strength and the sequence of our objectives. Pinning down enemy troops and equipment against our target-cloth and wood forces has meant success for a strike in another place.

Camouflage training has been given at the Tactical Center in Orlando to approximately 35,000 students during the past two years—students ranging in rank from buck privates to general officers. They are led along winding, booby-trapped trails by experienced instructors who lecture them on the technique of "making things seem something else."

These thousands are now scattered throughout every battle theater and with each is an AAFTC-learned picture of both defensive and offensive deception. They are part of a vast military machine which can and does win campaigns without benefit of deception—but they know a few neat tricks that, if needed, can be pulled out of Uncle Sam's hat. END

"And where the hell have you been?"



How electronics helps tell a knock from a boost...

THE MIT-Sperry Detonation Indicator is an engine instrument that discriminates between normal and abnormal combustion.

Through an electronic pickup, it *instantly detects detonation*—popularly called knocking or pinging—in most types of internal combustion engines. And it gives *immediate evaluation of detonation.*

As a result, warning is given at the time trouble *starts* . . . engine life is lengthened . . . mixture may be adjusted so that considerable fuel is saved . . . and the period between engine overhauls is extended.

No piercing of engine cylinders is required. Yet even the slightest detonation is signalled visually, and the faulty cylinder or cylinders spotted.

Use of the MIT-Sperry Detonation Indicator on airplanes results in remarkable fuel savings, longer engine life, greater safety.

The same is true of surface transportation which employs internal combustion engines.

Engine manufacturers find this instrument an invaluable aid in designing and testing. It also permits development of fuels exactly fitted to engine characteristics, thus increasing power output and lowering fuel costs. Also with the Knockometer, a special application of the Detonation Indicator, fuels with superior anti-knock characteristics can be developed and their quality production controlled.

Since 1937, Sperry engineers have been working on the perfection of a detonation indicator. This is but one of the many fields in which Sperry has pioneered in the field of electronic development.

Additional information on the MIT-Sperry Detonation Indicator is available on request.

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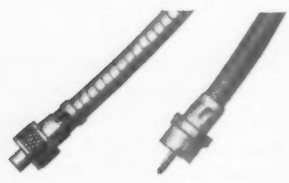

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Life on an 'Oil Slick'

(Continued from page 27)

the Battle of the Philippine Sea, the jeeps can talk above a whisper. When the Jap bombers came in dozens to attack the transports at Saipan the jeep pilots and jeep gunners met them head-on—and turned them back. The pilots and guns of Rear Adm. Felix B. Stump's flagship, a baby flat-top of the *Casablanca* (Kaiser) class, bagged 16 alone.

The typical Kaiser carrier has a flight deck only 480 feet long. That 480 feet of thick wood and thin metal would fit into many of your neighborhood theaters. It would even fit into some of your houses, if you took down a wall or two. It is 70 feet wide; that isn't as wide as the side streets in Thomasville, Ga. And yet the fastest fighter planes in the Navy land on it and take off from it. The *Hellcats, Wildcats, Avengers* work off the first-line jobs—and they work off the jeeps, too. But it takes better pilots on the baby flat-tops. There's that 480 feet compared with the 800 or more feet waiting for the big boys.

The pilots on the baby flat-tops know very well that they are better pilots than their confreres on the big tubs. It's very simple—no Dilberts could hit that 480 feet. Pilots on the coffins sit in a small, crowded, overheated room and dream of their brothers in the first line stretched out luxuriously in air-conditioned ready rooms, every pilot with a big cigar in his mouth and a crease in his britches. All those boys have to do is recline around on their spines waiting for somebody to tell them where the Jap fleet is. They go roaring off, shoot down a basketful of Japoons and come back to collect their medal and go home. Sure, every CVE pilot wants to get in the big-cigar league—just to get a little rest and relaxation and brush up on his poker playing. In the meantime he sweats it out.

Statistics will show, if pressed, that the jeep pilot flies more hours than any other carrier pilot. And each hour has more minutes in it. There are more pilots with sterns pounded parachute-numb on CVE's than any other place in the world. For instance they fly CAP. They fly CAP every day except when in port, and ports are so crowded with the big carriers that there's no room for CVE's. CAP is "combat air patrol." The CAP takes off, flies straight up to a certain altitude, levels off and sits up there, circling back and forth over the ships he is protecting from air attack. He strains his eyes looking for enemy aircraft; he strains his neck looking straight up over his head and all the way around him. He is certain that somebody has put large, sharp pieces of gravel under where he sits down. The weather is usually stinking, and the oxygen mask slowly squeezes his nose off, warps his head into peculiar shapes and pulls all his teeth. But he only has to do this for three or four hours. The rest of the time, if the troops aren't busy ashore, he throws away in routine practice flight making gunnery runs, bombing runs, formation runs, escorting torpedo bombers on simulated torpedo runs. And of course he flies ASP.

ASP—"anti-submarine patrol"—is even worse than CAP. For one thing the altitude is lower, the sun sits on the turtle back glaring at him and the sweat does not seem to soften the gravel in his parachute pack. On this patrol the pilot is looking for submarines. For some reason the water is always reflecting the sun right back in his eyes—it's like spending three or four hours looking at a welding arc.

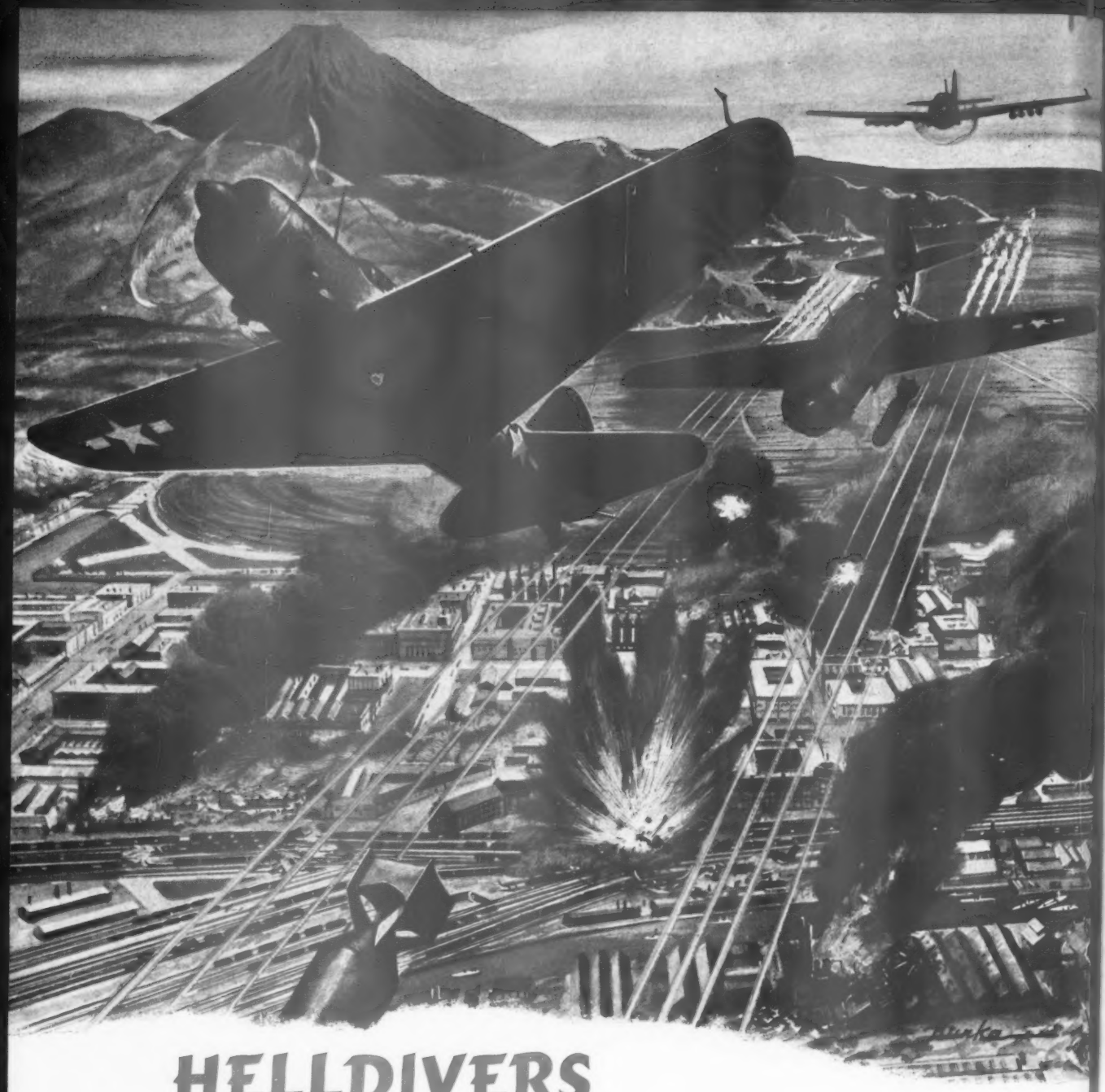
Finally, though, these poor devils really get down to work. D-day has come. There is light enough in the pre-dawn to see the viciously personal flashes of the antiaircraft on the ground as the CVE pilot starts his day—which may easily stretch into a week or a month. His first assignment is relatively easy. He is told to go hit this gun battery or strafe that line of pillboxes. Nothing to it—only a fierce suicidal resentment by the Japoons on the ground. He doesn't have to worry about hitting his own people. Or, as the sun comes up, he's told to make a run at 100 feet over the target and get us some pretty pictures of what the little bastards have waiting for the boys in the landing boats. Or he takes the "surf and swell expert"—usually a pretty grim young officer—along the beach so he can radio back to the assault commander the height and pitch and wave length, direction, force and speed of the waves the troops must go through, and the kind of

U. S. Navy's Grumman Night Fighters Hit Tokyo

F6F-5N Grumman Hellcats

Grumman

AIRCRAFT ENGINEERING CORPORATION, Bethpage, L. I., N. Y.



HELLDIVERS HIT TOKYO

Tokyo has now felt the Navy's new pile-driving punch. It's the carrier-borne Curtiss SB2C-4, latest in an already famed line of sluggers, and it lugs one of the greatest loads of destructive power ever mounted in a naval aircraft.

Ominously termed "The Beast" by flight crews, this potent dive-bomber retains the speed, range and climbing power of its Helldiver predecessors — yet — here is its inventory of death-dealing weapons. Two 20 mm wing cannons! 1000 pounds of bombs on wing racks! Better than 1000 pounds of fuselage bomb load! Eight 5 inch rockets! Two flexible machine guns!

Watch the reports from our Pacific Fleet and you'll know why the Japs watch the skies with fear and trembling. "The Beast" has a mission. It's to raise Hell with the Sons of Heaven.

Says an official Navy release, "The Helldiver . . . now our dive-bomber . . . has proved its worth time and time again in the Pacific campaign." Chances are several million bombed, blasted, rocketed residents of Japan will readily agree!

CURTISS AIRPLANES
DIVISION OF
CURTISS-WRIGHT
FIRST IN FLIGHT

beaches they must land on. Nothing much to this except that the wind whistles through the holes in the plane, put there by Japs who can sometimes hit him even with hand guns.

Or maybe he will lug the artillery spotter around all morning so that he can tell the guns where they're hitting.

Then, when H-hour is nearly there everything stops—except the pilots off the baby flat-tops. They have to prepare the beaches for the troops. The battlewagons, cruisers, destroyers, destroyer escorts stop the awful bombardment and the jeep pilots go to work. They strafe hell out of that section of the beach, they blast it with rockets and bombs. Up until the little boats like waterbugs are almost hitting the beach the CVE boys are forcing the Nips to keep their bullet heads down and their fingers off the trigger.

The troops are ashore now and that means the work is harder for the oil slick pilots—because Marines don't dawdle. "Go bomb target so-and-so, and strafe this-and-that," is the order, and the pilot must be careful all the way down that the American troops haven't gotten into his target area. When the target is a tank, he must be sure that he's got the right tank —not the one with the star, but the one with the sinking sun on it.

And when the day is over the CVE pilot is too tired to go around to the barrel where they keep the medals and get one. Too tired and in too big a hurry to get a few hours in a sweat soaked bed before the next day begins long before dawn and he has to do it all over again.

The CVE has come a long way in the Navy since it was first conceived. It still ferries planes. Some of them do nothing but ferry new fighter and torpedo planes from the west coast to Pearl Harbor. But these ferry boats are exceptions. Most of the CVE's are "assault" carriers now. They protect the great convoys of fighting men and machines across the huge and dangerous wastes of the world's biggest ocean. And when they reach the target—which is ever nearer Tokyo—the ludicrous little jeep carriers pound it down and keep it down. They protect the sitting-duck fleet of transports and supply ships from air and sub-surface attack by the enemy. Day after grinding day the officers and men, pilots and ship's company slave to get the job done.

There is no glamour in it, and damned little glory. It's hard for a CVE pilot to do a job "above and beyond the line of duty" for that line of duty is set so high. Nobody loves the oil slicks—except the troops, who trust the boys from the CVE's to help them when the fighting is bad. No, nobody loves the baby flat-tops except the troops—and, possibly, a few of the men who serve in them and fly from their tiny, galloping decks. END

Report from Washington

(*Continued from page* 43)

them of starting feeder airlines after the shooting stops. Inspectors report that they have found no difficulty in handling the crowd of applicants since the tests have been streamlined to meet the needs. Pilots need only present credentials to prove their flight status and pass a simple written examination on the Civil Air Regulations. Almost without exception they breeze through the exam easily.

Talk of giving pilots at foreign bases a similar break on civilian exams was knocked in the head in Washington by both civilian and military officials. Army makes the point that there are not adequate facilities abroad to give the tests and CAA's safety regulation service is already overworked and understaffed. However, there is this: cleaning up domestic applicants in uniform will leave veterans returning from abroad a place at the head of the post-war examination line.

Training Prospects

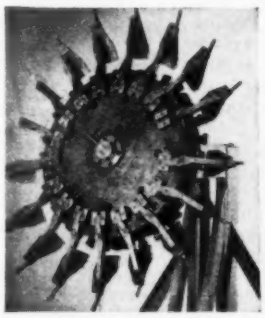
Ask anybody in Washington in the know about the prospects for Federally-subsidized pilot training post-war and you will probably be showered with pessimism. Aeronautical Training Society membership, operating at approximately 30 per cent of its wartime peak, looks for further AAF cuts if not an end of the program before fall. Post-war, it is thought, the Army will want to take over most if not all of its own training, Navy likewise. NATA leadership is equally dubious about the Federal training future, especially since the Bureau of the Budget knocked out a $100,000 appropriation for renewal of CPT under CAA auspices in the fiscal year beginning this

AIRPLANE AND PARTS CRAFTSMEN SINCE 1934

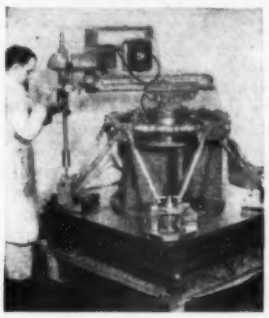
Skylark's craftsmanship on motor-mounts, bomb racks, control systems, wing fittings, and other vital airplane parts is helping American Air-Borne Craft to Victory today.

At the war's end, Skylark's skilled, experienced operators and precision facilities will be immediately available for peacetime production of airplane parts.

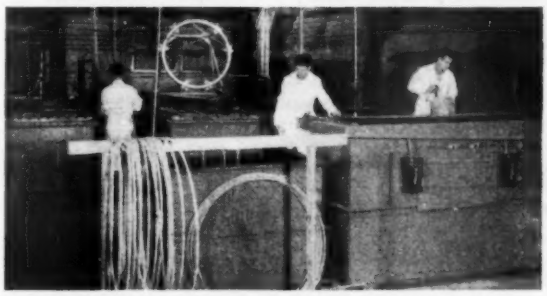
ENGINE MOUNT



WELD FIXTURE TOOL



ENGINE MOUNT MACHINING



PART OF THE LARGE PROCESSING DEPARTMENT WHERE THE ANODIZING, CADMIUM AND ZINC PLATING IS CARRIED ON BY SKILLED WORKERS

SKYLARK AIRPLANE & PARTS CRAFTSMEN SINCE 1934

Skylark Manufacturing Co., Inc., Venice, Calif.

Write us now for information about warcraft parts or "Skycraft."

NOTE: *Look to Skycraft* PRIVATE AIRPLANES FOR BETTER SAFER POSTWAR TRANSPORTATION

July. There is hope for those favoring Federal sponsorship. For instance, the Aviation Education Flight Training Committee, appointed by Department of Commerce's William A. M. Burden and headed by John Morgan, new executive head of the Aeronautical Chamber, has come out strongly for aviation courses in the grade schools and some Federal money for flight training in the colleges.

The law authorizing CPT programs will remain on the books for another year and needs only money to activate it. The whole attitude toward civilian pilot training may become more favorable now that the shooting has ended in Europe. It is, however, highly unlikely that the program will be resumed on a very large scale, at least before next summer or after victory over Japan.

Gas Rationing

Don't look for dropping of gas rationing for lightplanes. Paradoxically, there's more than enough 86-and-less-octane gasoline for the non-scheduled planes but a score of other factors makes rationing mandatory for some time to come. High policy, as expressed by the War Production Board (which turns the gas over to CAA for rationing to the pilots) is that, speaking generally, private pilots must take their rationing with Class A coupon holders in the automobile field. Otherwise, automobilists, who are the chief beefers about gas for putt-putts, will raise such an uproar that non-scheduled rationing would have to be tightened. And no amount of explaining the situation in terms of the facts would silence the uproar.

Facts are that, if the 2,000 barrels used daily by non-scheduled operators were added to the available supply of automobile gasoline, it would mean one-sixth of a gallon more gas a year for every A-card holder.

Even though getting this limited supply, there have been few complaints from lightplane and non-scheduled operators. On the contrary, they have leaned over backwards to observe the spirit as well as the letter of the rationing rules. AOPA, for instance, recently vetoed two mass flights, one in Colorado and another in Wisconsin, although the flights could have been legitimately okayed by CAA as part of a national survey of airport needs.

Military Brakes

Another important factor in keeping the rationing enforced is the post-VE Day situation, which highlights the foundation fact of all gas rationing—that it has nothing to do with a gasoline shortage. Cars are rationed to save the automobile itself and to save rubber. Similarly, planes may be rationed as a wartime expediency and not because of a gas shortage. Matter of fact, aviation gas refiners report the stuff is coming out of their ears.

But rationing may be used to keep lightplanes out of the air most of the time, especially on the West Coast. Pressures to relieve current West Coast restrictions on private flying were heightened with VE day, but the military out that way still has a case that they think is important. Redeployment toward Japan means heavy traffic in West Coast areas. Putt-putts and non-scheduled planes interfere with this traffic. Those who fly them, long under military dominance, may become super-restive if they are grounded on the plea of military necessity. The Army solution, now being considered, is stringent rationing. It's not an imminent possibility but don't rule it out.

Otherwise there's all the gas that private and non-scheduled planes need under present circumstances, according to Washington sources. Pilots are able to meet their aerial commitments without inconvenience. Only beefs have been from a handful of flyers who don't like the necessary paper work and have, therefore, botched it. A few complaints have come from itinerants who have landed beside an empty pump, but such occurrences are rare.

5 YEARS AGO

FROM the July, 1930, issue of this magazine:

The Curtiss-Wright *Tanager* took first place in the $100,000 Guggenheim Safe-Aircraft Competition.

Latest Ford tri-motor transport plane was equipped with Packard Diesel engines. This model carried from nine to 11 passengers at 100 m.p.h. cruising, 116 m.p.h. top speed. It had a service ceiling of 14,000 feet, landed at 55 m.p.h.

Simplex Aircraft announced their *Kite*, a two-place monoplane with a 30-40-h.p. engine. Plane's top speed, 75 m.p.h., landing speed, 20 m.p.h. Wing span, 39 feet, gross weight, 975 pounds, cost, $1,985.

Reverse thrust propellers were demonstrated at the Western Aircraft exhibit. Changing pitch of propellers and reversing the direction of thrust enabled braking power to be obtained.

Gilbert G. Budwig, director of air regulations, Aeronautics Branch, Department of Commerce, announced a new pilot license examination to be given applicants for various pilot grades. The list, totalling 250 questions, included: May an unlicensed pilot in an unlicensed airplane carry passengers for pay from one state to another?

A $600 power-glider, the *Crawford*, was announced as available at Seal Beach, Calif. It was powered with a motorcycle engine, had a total loaded weight of 500 pounds, and a wing loading of 2.5 pounds per square foot. A geared countershaft drove the propeller at half the engine speed.

Plans for the 1930 Air Races to be held at the Curtiss-Reynolds airport at Chicago were being completed. Prizes totaling $100,000 were assured.

Capt. Boris Sergievsky, chief pilot for Sikorsky Aircraft, broke the American seaplane altitude record by lifting a dead load of 1,102 pounds to an altitude of 26,000 feet.

Gerard F. Vultee, chief engineer of Lockheed Aircraft, stated that "science has handed aviation 25 m.p.h. without charge." It was found that streamlining fairings—oval metal coverings—over the wheels added from five to seven m.p.h. and metal engine cowlings gave an additional 20 m.p.h.

International Air Transport

Dr. L. C. Sorrell, Air Transport Association researcher, recently estimated that airlines post-war should quickly pick up as much as half of the sea-going passenger traffic without any great damage to U. S. shipping interests. Foreign ships in the tourist trade will be hardest hit.

The lightplane is not being neglected in plans underway abroad for post-war flying. Argentina is leading the way with a program to give the flyer the same service given motorists. Some 30 airports are being built at a cost of nearly $3,000,000 and there also will be provisions for servicing planes, trip data and a trained corps of attendants.

Peru, Chile, and Brazil have announced plans for building a chain of hotels to accommodate flying tourists post-war. Peru's chain is already partially in operation.

An aid to post-war Atlantic flights was authorized recently when the Senate appropriated $960,000 for a seadrome to aid in over-ocean weather forecasting. Charles I. Stanton, CAA deputy administrator, testified in support of the bill and described the seadrome as 180 feet long, 90 feet wide, with a platform 45 feet above the water. It will be manned by a crew of 17.

Suicide Mission

Nothing official has yet been released but we have it from responsible sources that Lieut. Joseph P. Kennedy, Jr., 27-year-old son of the former ambassador to London, was killed under unusual circumstances. The Army was determined to knock out certain V-1 launching sites on the Cherbourg peninsula. So, more in desperation than anything else, they rigged up a *Liberator* bomber, filling it full of TNT—so much of it that it could carry only enough gas to fly across the channel. Its pilots were Lieutenant Kennedy and another officer. They were to fly over to the V-1 sites and by some unexplained method they were to aim that whole plane-load of TNT at the target, bailing out as soon as they had everything set.

They took off from an air station on the channel coast of England on August 12, 1944, but they got just a few miles out from their base when the whole load of TNT suddenly exploded. Several people reported having seen the explosion from the shore.

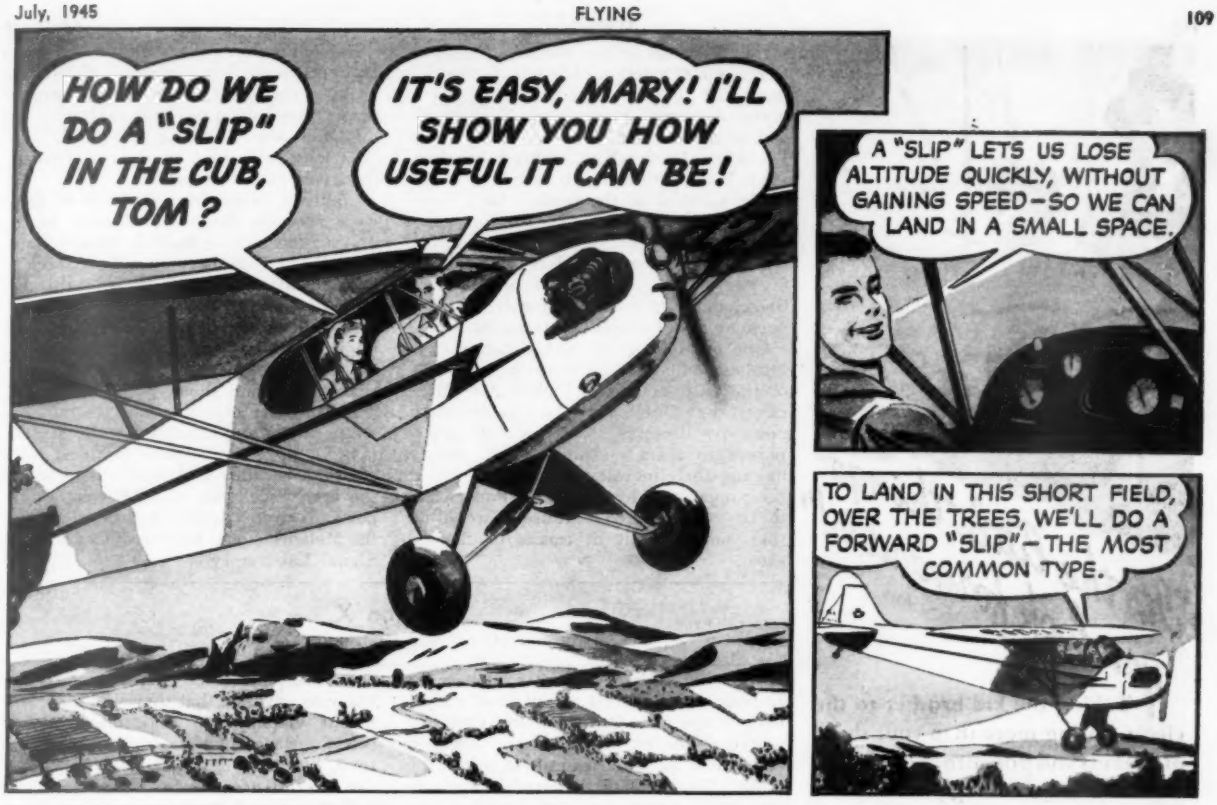
Briefings

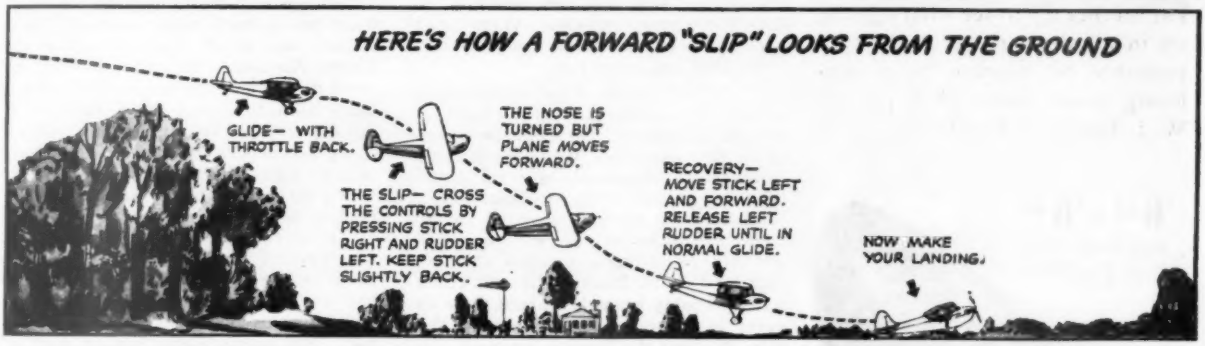
Republic just got an order for 50 modified *Seabees*, powered with 185-h.p. geared Franklin engines, giving the plane 235 h.p. for take-off.

Because it is as big as a medium bomber and carries specialized radar equipment, Northrop's *Black Widow* night fighter costs $240,000.

Six cents a pound—4½¢ reduction—is the new rate on sea food by air express recently announced by Railway Express Agency between Charleston and Savannah, and Atlanta.

If you want to buy a glider or sail-


HOW DO WE DO A "SLIP" IN THE CUB, TOM?
IT'S EASY, MARY! I'LL SHOW YOU HOW USEFUL IT CAN BE!
A "SLIP" LETS US LOSE ALTITUDE QUICKLY, WITHOUT GAINING SPEED—SO WE CAN LAND IN A SMALL SPACE.
TO LAND IN THIS SHORT FIELD, OVER THE TREES, WE'LL DO A FORWARD "SLIP"—THE MOST COMMON TYPE.


HERE'S HOW A FORWARD "SLIP" LOOKS FROM THE GROUND
GLIDE— WITH THROTTLE BACK.
THE SLIP— CROSS THE CONTROLS BY PRESSING STICK RIGHT AND RUDDER LEFT. KEEP STICK SLIGHTLY BACK.
THE NOSE IS TURNED BUT PLANE MOVES FORWARD.
RECOVERY— MOVE STICK LEFT AND FORWARD. RELEASE LEFT RUDDER UNTIL IN NORMAL GLIDE.
NOW MAKE YOUR LANDING.

Get Your "How to Fly" Booklet NOW!

"How to Fly a Piper Cub," covers the fundamentals of flying with over 50 step-by-step photos and descriptions. Many other facts, full-color pictures of Piper Cubs. Send 10c in stamps or coin for postage-handling. Write Piper Aircraft Corporation, Dept. PA75, Lock Haven, Pennsylvania.

NOTE: *This lesson and others that will follow explain only the fundamentals. See your Piper Cub dealer for actual flying instruction.*

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It should plan landing facilities now—for its citizens and its future. The booklet, "What Your Town Needs for the Coming Air Age," illustrates various types. It covers benefits, where to build and how to start. For your free copy write Piper Aircraft Corporation, Dept. PA75W, Lock Haven, Pennsylvania.

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FILMS AVAILABLE

Movie films that will be a great help in teaching the fundamentals of flying and plane construction are available to you. Interesting, clear, instructive sound narration. Write for information describing films on "How to Fly" and "The Construction of a Light Airplane."

PIPER AIRCRAFT CORPORATION
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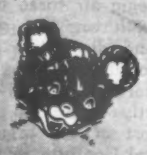

PIPER CUB

Points the Way to Wings for ALL Americans

plane, Reconstruction Finance Corporation has a few left at this writing, priced from $350 to $525. Types include three-place Aeronca, Piper, and Taylorcraft utility gliders, and one- to three-place Frankfort, Laister-Kauffmann, Schweizer, Pratt-Read and Briegleb sailplanes. All but a handful of the models have been approved by CAA for civil use.

Speaking of gliders, Army is ordering big numbers of troop gliders for the Pacific war. Mostly Wacos, two or three of the models are unconventional. Navy is back at glider experiments again, too.

One bombing story with a happy ending has come out of Europe in the wake of the Nazi collapse. Eighth Air Force pilots kept Dutch patriots supplied with news by dropping waterproofed newspapers to them on night runs, greatly helping their morale and aiding them in their opposition to the Nazis. Papers had to be waterproofed because more often than not they lit in canals or flooded areas.

Here's another paper-bomb story, maybe apocryphal, but amusing. Seems we dropped surrender passes to the Germans before they folded in northern Italy. But they fell into the hands of Italian Fascists who sold them to their war-weary Nazi pals at a neat profit.

Eighteen locomotives, built in 92 days, were recently flown into Burma in the first air-locomotive flight in history. General Brehon Somervell asked for the transportation job, ATC carried it through without a hitch.

A wall-motto displayed at the AAF public relations office, Pentagon reads: "When in trouble, when in doubt, run in circles, leap and shout."

An aircraft psychrometer, to measure temperature and humidity while a plane is in flight, is now installed in many *Fortresses, Liberators* and *Mitchells* to add to the high excellence of AAF weather reports. The instrument was developed by the Meteorological Branch of Camp Evans Signal Laboratory. END

Mission X

(*Continued from page 47*)

days a year. Men frequently labored for 72 hours without rest to put their planes back in the air. Ordnance and chemical workers loaded more than 3,000,000 bombs and incendiaries in 1944, mostly by night. The work of thousands went into the driving, servicing and repair of the 8th's 25,000 motor vehicles. At one headquarters alone, telephone operators handled 14,000 calls each day.

The "story" begins at the top where the orders which energized this huge air armada originated. The fantastic success of the Red Army lies just as much in the brilliance of its generals as in the superb fighting qualities of the Russian soldier. Similarly, the success story of the 8th could hardly be written were it not for the men in its higher echelon. Yet, except for General Doolittle himself, Americans probably know less about these experts in air operational planning than they do about the Russian generals.

These experts are men who have made their mark in other fields as well as in the military—men like Maj. Gen. Orvil Anderson, deputy commander, long a noted balloonist and tactician; the director of intelligence, Col. William T. Gardiner, twice governor of Maine; Brig. Gen. J. S. Allard, chief of staff, former Curtiss-Wright executive; Col. George Jones, an executive with Harper Brothers publishing house before the war. To these competent men and their associates was entrusted the destiny of the 8th. What happened that day before Christmas, 1944, happened because *they* completed the operational planning which enabled the giant force to strike effectively.

What is meant by operational planning? Here is approximately what the term implies:

Each morning General Doolittle held a staff conference in his War Room. Here he was briefed by the staff weather officer from a special forecasting map as to base, route, and target conditions within the operational sphere of the Eighth. You cannot dispatch 2,000 bombers unless you know in advance that they will have sufficient visibility to take off and land safely. Bases may be open at take-off time, but they must also be open when the aircraft are due to land.

Underground in the operations room there was a large map, electrically controlled, on which was plotted every United Kingdom base. Red lights indicated the fields that were closed in; green lights those that were open. From these devices the general got an idea of how many bombers and fighters were available for take-off and all possible fields to which they might be diverted after completing the mission.

During the break-through period the 8th operated for 13 consecutive days in some of the worst flying weather they had ever encountered. At some bases visibility was restricted to less than 600 feet. Yet bombers and fighters took off and returned safely. On one mission the entire bomber-fighter force was successfully diverted for a loss of only five aircraft. Weather planes probed the skyways at all hours of the day and night reporting on continental conditions and approaching cloud fronts. It was the usual thing for weather men to hear the report: "weather was exactly as you predicted at the briefing."

Having selected the most likely operational area and an alternative, decision was made as to the type of targets. The general consulted his target chief and was informed of the latest priorities on all categories of targets: i n d u s t r i a l, counter-air, transportation, communications, etc. As a strategic air force the main objective of the 8th was the progressive destruction and dislocation of the German war potential. However, if the army requested priority—as it did on D-day and subsequently at St. Lo, at Brest, and during most of the break-through period—General Doolittle would commit the 8th to tactical bombing.

When the g e n e r a l chose the area

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and the targets, he would turn over the operation to his staff, to whip up and "lay it on" with assembly-line smoothness. For a typical operation they would work far into the night in the underground operations room. The weather would be rechecked. They made certain the target area was still open and decided whether it must be bombed visually or by means of the "magic eye." When instrument bombing was required the "magic eye" expert contributed necessary data on which the crews were briefed.

The "damage book" was studied. This is a graphic presentation of damage inflicted on each strategic target, synthesized from pictures taken by photo reconnaissance. Photo reconnaissance aircraft were out every day evaluating pictorially the effects of the 8th's bombing. By means of the "damage book" the exact portion of a target as yet unhit was pin-pointed for destruction and appropriate aiming points chosen whereby bombardiers were able to score hits. (Incidentally, the Harriman mission to Russia carried along a special copy of the "damage book" to show Marshal Stalin what the 8th was accomplishing.)

Bomber and fighter controllers estimated how many bombers would be required to neutralize each given target and what escort must be provided to chaperone them safely to and from the target. Were there any fighters left over? If so, they could be used to strafe unsuspecting airdromes or perhaps sink their .50-calibers into a full oil storage tank or a juicy stretch of railroad. Jerry will never forget the terrific shellacking fighters gave his transportation and communications during his flight across France.

Routes in and out had to be figured. Here the antiaircraft expert entered the picture. Each day he prepared a map on the positions of some thousands of German heavy antiaircraft guns. "It might be better to turn off the track at this point," he suggests, "the flak won't be so heavy." The bomber controller consulted the enemy reaction expert about the Hun's strength in the given area. When it's a problem in communications the signal chief was always handy. When oil targets were to receive the 8th's attention, the expert on German smoke screen counter-measure was consulted. His original research made it possible for bombardiers of the 8th to increase their accuracy against smoked-veiled targets.

For a tactical mission in direct co-operation with the Army it was still another matter. You can't let bombs drop at random in a tactical area without expecting to hit your own troops, not when you're often bombing from 25,000 feet. Hence, Intelligence supplied the latest forward line of our troops, including a bomb-line, that margin of safety between our stabilized forward positions and those of the enemy.

It was teamwork from beginning to end that did the trick, enabling combat crews of this giant force to be briefed and ready for take-off by zero hour the next morning. During the night their intelligence and operations received the field order, the teletyped blueprint of the entire mission as prepared by Doolittle's staff. Down the echelons it flashed—division, wing, group. All the thousand and one details were collated into a recognizable formula on the basis of which bombers and fighters could take off, assemble and rendezvous, hit their targets, and return safely to base with a minimum of loss. On several occasions the 8th dispatched and returned its entire force without a single loss. Try to imagine dispatching 1,500 trucks on a 1,000-mile journey without a mishap—even without *flak*.

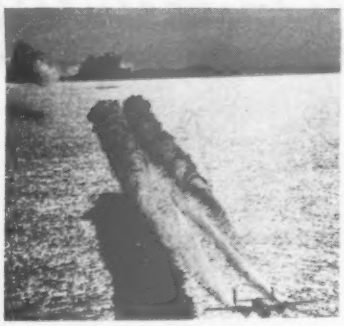
And the mission didn't end when the last aircraft landed. Interrogation followed and information shot back up the line into the reporting units of Intelligence and Operations located in the underground nerve center. Here it was sifted and evaluated, then funneled to proper Allied headquarters. Intelligence prepared a daily "Intops Summary," a report of all Allied ground and air operations in the European Theater. From headquarters of Field Marshall Montgomery and Lieutenant General Bradley came reports on the daily progress of ground operations. From far-away Italy, 15th Air Force radioed its attack results. Across the Channel, 9th Air Force wired a summary of British and American tactical sorties, while here in England the RAF kept the 8th informed of target intentions as well as bombing results. By eight o'clock in the morning General Doolittle knew the complete picture. It was neatly packaged for him in the "Intops Summary."

What about the results of the 8th's own bombing? All through the night photo interpreters labored analyzing and assessing the "strike attack" films. They plotted the trajectory of the fallen bombs. They pin-pointed the damage and compared it with the previous cumulative destruction, ferreting out new damage. Then they classified results—excellent, very good, good, fair, poor, or unobserved, depending on the degree of accuracy. In the morning the photo intelligence expert would brief General Doolittle. The results of the "strike attacks" influenced his decision on the selection of targets for the very next mission. The 8th learned by doing. It maintained a special research and analysis section staffed by competent civilians as well as military personnel.

Around take-off time every day, staff members briefed General Doolittle on the completed planning. Then he concentrated on the coming mission. It wasn't all smooth sailing. Especially in baffling weather. On one mission an entire force of *Liberators* had to return to base because a wall of cloud up to 30,000 feet suddenly blocked their route. According to the weatherman it was supposed to be miles northward. In came an unpredicted wind and sent the cloud front galloping south. Another time, an adverse report was flashed to the general after the heavies and their "little friends" had already assembled. He had to do some fast thinking in order to make the mission profitable. It amounted to changing the bomber track in mid-air. But it was done. Secondary targets were heavily plastered instead.

In making these momentous decisions the general was tantamount to the head of an unimaginably huge combine. Only instead of dealing in commodities and products he dealt with a large portion of the human and material resources of the American people.

The wise employment of this arsenal in the 8th's development of daylight precision assault was the prime function of the higher echelon. END



AERIAL SMOKE SCREENS

HEAVY smoke screens laid by low-flying U. S. aircraft have been adapted to both attack and defensive tactics. Dense clouds of white smoke hugging ground or water cover troop movements on land and ship maneuvers at sea. Tanks filled with the chemical creating the smoke mantle are affixed to bombers, such as the *Mitchell* shown at left laying a water smoke screen, and to fighter craft.

Crewmen filling the smoke tanks are protected against the acid base of the liquid smoke by wearing rubber boots, gloves, aprons and gas masks (right). Crew first-aid man at left holds water spray for any leak that might occur. First-aid kit stands ready on ground.

Colored smoke is also used by U. S. forces as signals. The signal plan, based on six colors derived from three basic shades, is changed daily to confuse the enemy.

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- how to determine track, ground speed and wind between fixes (p. 130)
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- how to prepare a calibration graph showing the amount of correction to be applied to any relative radio bearing (p. 57)
- how to conduct a fixed square search when E.T.A. has elapsed and destination has not been sighted (p. 156)
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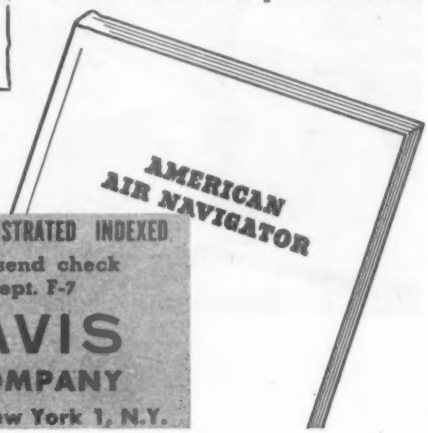

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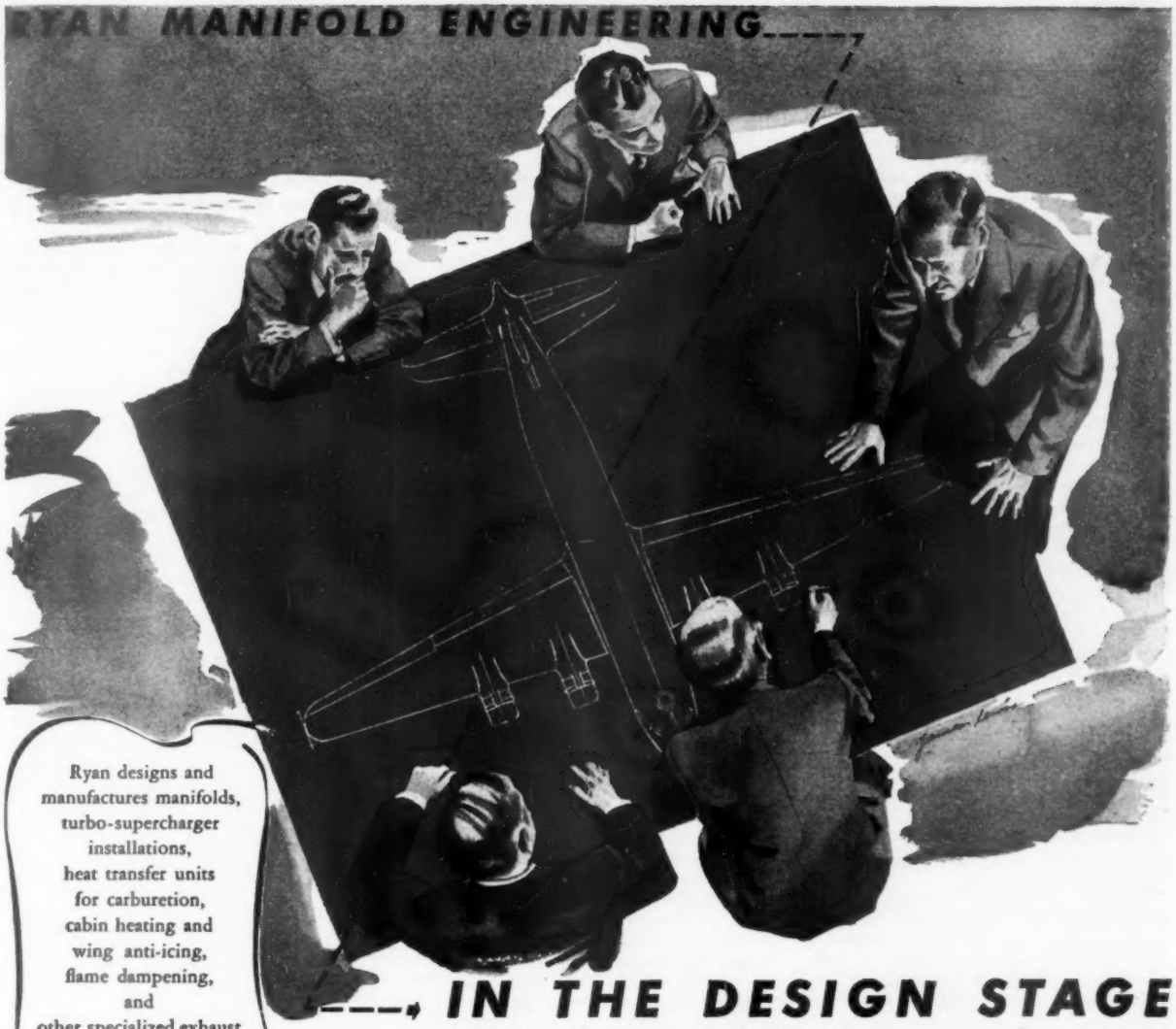

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Let's Simplify Navigation

(*Continued from page 34*)

force) near the "poles" is somewhat greater than would exist if these areas were actual magnetic poles.

The area in which the magnetic force is exerted vertically instead of horizontally is so widespread that the magnetic compass proves useless as a directional indicator when within several hundred miles of the "poles," and it is necessary to use some other method of determining courses when flying within this radius. During the past few years, when it has become practical to fly at high altitudes using great-circle courses to shorten the distance between continents, this limitation has acquired significance to pilots and many devices are now being developed to overcome the handicap.

In view of the characteristics just described, the theory now generally accepted by scientists is that the earth itself is a spherical magnet with no true "poles." For convenience, the areas in the north and south where the lines of force are practically vertical to the earth's surface are called the north and south magnetic poles.

The magnetic forces emanating from the earth are subject to many influences, among which are probably the sun, the moon, the motion of the atmosphere, the tilting of the earth's axis, and possibly some form of motion occurring within the molten mass beneath the surface. These influences cause directional changes in the lines of magnetic force, some of which can be anticipated and others which are as unpredictable as the weather.

While there may be no known relationship between the weather and the magnetic forces of the earth, the parallel is strikingly similar in many respects. There is a daily variation in magnetic activity which can be predicted rather accurately just as weather changes can be determined for a short period with reasonable certainty. There is also a seasonal change in magnetism which may be predicted with only about the same degree of accuracy as the *Farmer's Almanac* foretells the weather. Furthermore, there is a long-range activity known as *secular change* which seems to extend over decades or centuries. This also has a parallel in the weather. Geological research has proved that weather conditions over a period of years are subject to cyclical changes. One other similarity is apparent between geomagnetism and the weather. Violent magnetic disturbances sometimes occur called "magnetic storms." These are spasmodic irregularities which have their counterparts in tornadoes, hurricanes, and cyclones.

The daily changes in magnetic force are so slight as to be of no particular significance to pilots. Yet it is interesting to note that the needle of a delicate compass will perform a daily cycle of activity. In the northern hemisphere shortly before sunrise the needle will begin to swing to the right; about mid-morning it will reverse; by mid-afternoon it will be slightly to the left of its original position. From this point it will swing back, so that shortly after sunset it will have completed its daily activity and will remain relatively constant until the next sunrise.

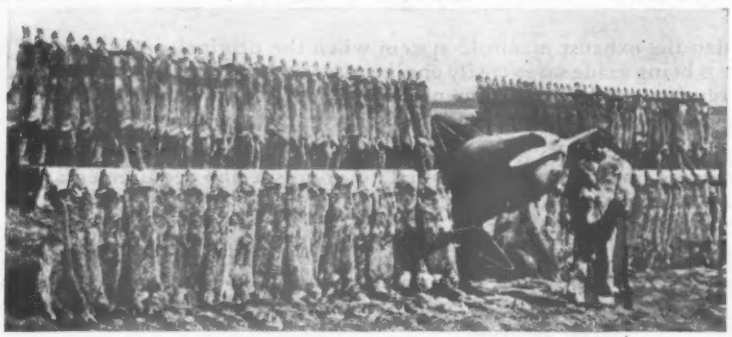
The seasonal change is also so slight as to be negligible. The secular change, however, is of great importance. The lines of force which govern the direction in which the compass needle points seem to be in a constant state of flux. Some of the lines swing in one direction; others in the opposite direction; while still others remain steady. The "magnetic poles" themselves do not move sufficiently to explain the activities of the lines of force. The extent of the secular change can be illustrated by the amount of magnetic variation occurring in one location over a period of years. For example, a compass located at Washington, D. C., in 1810 would point directly toward the true north pole. In 1940 the same compass in the same location would point 7° to the west of true north.

Accurate knowledge of the earth's magnetic field is of vital importance. The information is invaluable for laying out boundaries by use of the magnetic compass, and for all forms of surveying. Magnetic observations obtained along seacoasts and in harbors and lakes are essential for maritime navigation. With the comparatively recent development of aviation, magnetic data became of tremendous significance to flying.

Scientific study and research has not yet been able to discover a set of fundamental principles to account for many features of geomagnetism; consequently, in order to determine the extent of variation accurately, it has been necessary to make frequent measurements at specific geographical locations. In the United States there are about 7,000 "magnetic stations" which have been established by the U. S. Coast and Geodetic Survey during the past 100 years. In addition, the Lake Survey has made observations on inland waterways. In 1910 the Carnegie Institution equipped a nonmagnetic yacht, constructed of wood and bronze, to carry out research on magnetic influences over oceans. Unfortunately this ship was destroyed by explosion and fire in 1929 and has not been replaced. On page 32 is a reproduction of the bronze plate which is imbedded in concrete at the magnetic stations of the Coast and Geodetic Survey.

From statistics obtained by these various means the general magnetic pattern becomes quite clear. In the northern hemisphere the lines of force converge in an area lying in northern Canada and about 1,300 miles from the true north pole —approximately Lat. 71° North, Long. 96° West. The corresponding area in the southern hemisphere is at Lat. 72° South, Long. 155° East. A straight line connecting these two areas would not pass through the center of the earth; hence the two poles are not diametrically opposite.

For the reasons given above, the magnetic meridians are not (as might be supposed) great circles drawn through the magnetic poles. Moreover, in certain localities, due to "local disturbances," the indication of the compass needle will vary by many degrees from the normal direction of magnetic north. Only in a very general sense can it be said that the compass needle points toward the magnetic pole. Nevertheless, the difference in the location of the true north pole and the magnetic north pole accounts largely for the magnetic variation so familiar to pilots. On the west coast of the United States the compass needle usually will point 15° to 24° east of true north; in the state of Maine the needle will point about the same number of degrees west of true north. On a line running roughly through Lake Michigan and off the east



COYOTE KILLER

USING his Piper *Cub* as a fur display rack, Ray Schenck shows the results of his one-man air hunt against coyotes, foxes and wolves in the vicinity of Clarinda, Ia. The total bag shown here consists of 99 foxes, 32 coyotes and one wolf. He was alone on most of his aerial hunting trips which were made with special permission from the CAA.

Ridding the area of these pests by spotting the animals from a low-flying plane and shooting them with a shotgun has proved profitable. The bounty is $5 each with an equal value for the skins.

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coast of Florida the compass needle will point approximately true north. Each isogonic line is labeled to show the number of degrees of variation—and the direction of variation, i.e., to indicate the number of degrees the compass will point to the east or to the west of the true north pole. Illustrated on page 32 is an isogonic chart for 1940.

It was quite natural that when the necessity for aeronautical charts became apparent, the project was assigned to the Coast and Geodetic Survey which had been constructing maritime charts. While most maritime charts bore no isogonic lines (magnetic variation was indicated by compass roses and special notations) it was natural to suppose that the isogonic lines which had served satisfactorily for surveyors and were, after all, indications of the behavior of compasses on land, should be superimposed upon aeronautical charts for the use of pilots. Furthermore, it was natural to assume that the same technique used by mariners should be adopted by flyers for aerial navigation.

What we may have failed to realize is that the pilot is carrying on his activities in a bright new three-dimensional atmosphere. The navigational methods of ocean-going craft are not adequate for fast airplanes. The mariner can compute his course and bearings at leisure, with adequate facilities and equipment; the aerial pilot frequently works in cramped space with limited equipment and must perform his operations quickly.

The captains and mates who lay out courses for ships are usually experienced in that art and have devoted serious study to it; the pilots of airplanes, with the exception of airline pilots and military pilots, are treating flying as a hobby and have neither the time nor the interest to perfect their skill.

Moreover, the pilot is not an engineer or a surveyor. The local magnetic disturbances shown by the isogonic lines are of no consequence to him. At a speed of 100 or more m.p.h. he passes over many of the isogonic kinks before his compass needle even has time to swing to right or left. Besides, if he is flying on gyro instruments, he pays little attention to the fluctuations of the magnetic compass, using it only occasionally to reset his gyro. The pilot therefore is not interested in the niceties of accurate surface measurement but is definitely concerned with general or average values over his areas of flight.

These can be shown more readily by magnetic meridians, which even out the irregularities and furnish an over-all pattern. On page 33 are shown approximate magnetic meridians for most of North America, as compared with the isogonic lines in the chart on page 32.

A recent study of the magnetic phenomena reveals the interesting fact that the isogonic lines as shown on aeronautical charts may actually furnish false information to the pilot. The effects of local magnetic disturbance are largely confined to the surface areas and do not usually extend to flight altitudes. This thesis was proved mathematically in 1940 by Dr. H. H. Howe of the Geomagnetism division of the Coast and Geodetic Survey and was later borne out by actual flight tests.

Ordinarily a pilot will disregard indications of local disturbances shown by the kinks in isogonic lines. However, if he were to apply these ground values to obtain a compass correction and fly strictly according to the data, he would undoubtedly be thrown off his course, particularly if flying through overcast. In mountainous terrain such a condition could lead to extremely serious consequences.

At Port Snettisham, in southeastern Alaska, there is a local magnetic disturbance along the shore line which causes the compass needle to shift more than 130° within the space of less than a mile. In 1941 an experiment was conducted by the Coast and Geodetic Survey with the cooperation of the Sitka Naval Air Station, in which an airplane was flown over the area at varying altitudes. According to the report of R. E. Gebhardt, who conducted the experiment, the disturbance, which extends over an area of about 20 square miles, had no effect upon the compass of an airplane flown above 3,000 feet altitude. So far as is known, no further investigation has been made to establish reliable statistics regarding the effect of altitude on local variation but it would appear to be a field well worth investigating.

When the writer, wishing to make a further study of the forces of geomagnetism as applied to flight, requested a map showing magnetic meridians plotted for the North American continent, the U. S. Coast and Geodetic Survey discovered that no such map had ever been drawn. However, by using the data from which isogonic lines are drawn, the Division of Geomagnetism and Seismology was able to plot the magnetic meridians. Thus an entirely new type of chart is shown on page 33.

From the diagram it can be seen that the magnetic meridians have a pronounced curve near the pole but gradually straighten out as they pass through the middle latitudes. When projected upon small scale charts such as the sectional and regional charts used for aeronautical navigation in the United States, the lines appear almost straight, with a departure of not more than one or two degrees. This is illustrated on page 34. Using a protractor to measure against one of these lines involves no difficulty and in fact tends to average out the slight curvature, bringing the measurement within a very close tolerance.

The magnetic meridians themselves have no single values corresponding to the values placed upon the isogonic lines. However, they are drawn in accordance with the same fundamental data and for those who wish to know the amount of variation, figures indicating the changing magnetic variation can be placed along each magnetic meridian. With this scheme of identification the magnetic meridians will not only serve for the special function of course measurement as

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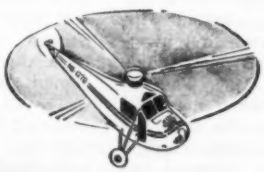

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outlined previously but will, in addition, provide all the useful information now given to the pilot by the isogonic lines.

Some airline and military pilots who have perfected their technique in the method of computing courses by the use of isogonic lines might prefer the present method. For them the magnetic meridians will provide the same data now obtainable on the isogonic lines. Thus they will suffer no inconvenience whatever. For other pilots and for beginning students the magnetic meridians will provide the advantage of simplicity, enabling them to make the necessary calculations with speed and accuracy equal to that of professional navigators working with conventional maps.

It is not surprising that the use of magnetic meridians for aerial navigation should be an entirely new concept. Much research has been done and many instruments have been devised to make the computation of courses less tedious for the pilot but it had always been assumed that magnetic variation, because of its irregularity, would require an extra step in the computation. Moreover, the discrepancy between ground observations and flight conditions became apparent only within the past few years and the full implications of this situation seem to have escaped attention.

At the present time the Civil Aeronautics Administration, the chart divison of the Coast and Geodetic Survey, and the Division of Geomagnetism and Seismology are considering this new proposal with a view toward uncovering its fullest possibilities.

If, as a result, the aeronautical charts are changed and the magnetic meridians are substituted for isogonic lines, the learning and practice of navigation will become relatively easy and the safety of pilots and passengers on instrument flight will be greatly increased.

The proposed change would, of course, require a complete reprinting of all aeronautical charts. But this would appear worthwhile in view of the obvious advantages. The expense would be negligible for the reason that the Coast and Geodetic Survey ordinarily reprints all aeronautical charts at intervals of six months to a year. It would therefore be possible to make the change-over at the time each chart is reprinted, and since the regular lines of latitude and longitude and the magnetic meridians would appear on the same chart, either the present method of plotting or the one proposed herein could be used. In this way the entire project could be completed within a year and one of the most troublesome factors in navigation would be reduced to a simple automatic measurement. END

A Tax Plan for Aviation

(*Continued from page* 31)

hold possessions or other personal property was then taxed. Automobiles are still subject to general or special property taxes in two-thirds of the states and in the other third vestiges of the personal property tax remain in the special forms or rates of their state registration taxes.

The original basis for beginning state registration of automobiles was purely one of law enforcement. Early automobiles, like early airplanes, were considered by average citizens as very dangerous, extremely destructive, and persistent nuisances. Thus, need for regulations led to their first registration in New York in 1901. Every state was making use of the device by 1917. Revenue potentials of vehicle registration went unnoticed at first. A permanent license was usually issued. But after 1910 more and more states began to require annual registration and the payment of larger and larger registration fees. Fees graduated with the size of the vehicle were first introduced in Ohio in 1906 and the practice was nearly universal by 1920. The decade of 1910-1920 also marked the fiscal amplification of the registration tax. Refinement in the tax has largely marked subsequent developments. Federal use taxation of automobiles ($5 stamp tax) did not begin until 1941. It was almost universally opposed by the states, and many Federal officials seemed to agree with them. Subsequent developments indicate this may be the first tax proposed for repeal after the war.

Two years following complete state adoption of motor vehicle registration taxation, state taxation of motor fuel began in Oregon—in 1919. Ten years later all states were taxing gasoline used on highways and were devoting 98 per cent of collections to highways. Since 1930 it has been the most productive highway user tax. Originally imposed as a minor supplement to the annual registration tax for the purpose of covering the factor of highway use, the motor fuel tax has become the major source of highway revenue in many states. In 1940 it produced approximately twice as much revenue as state registration taxes and actually yielded one-fourth of total state tax collections.

Federal invasion of the fuel tax field did not begin until 1932. Since then it has always lacked two of the most important user tax characteristics recognized in state fuel taxes. First, there is no apparent relationship between Federal appropriations for highways and amounts collected from Federal fuel taxes. Federal highway aid began way back in 1916. Second, the Federal Government has never made distinction between fuel consumed on highways and that consumed by aviation, agriculture, industry and other off-highway users. Most states tax only that part of motor fuel burned on highways. The rest is tax exempt.

Obviously there are many details in this picture that cannot be transposed into current plans for aviation taxation. Analysis of the taxes imposed upon air carriers, however, does show that taxes paid are, in order of their importance, net income taxes, aviation fuel and oil taxes, payroll taxes, capital stock taxes, and gross receipts taxes. Surveys of aviation potentials show further that the most important post-war revenues prob-

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ably will be derived from personal property, aviation fuel and unemployment compensation taxes. And though registration taxes are still undeveloped, this situation cannot long endure once mass production of aircraft is slanted toward civilian consumption. The whole situation, therefore, parallels very closely the one which was experienced in the development of automotive transportation.

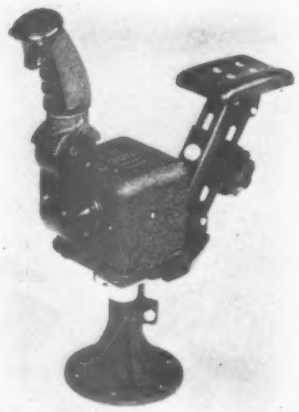
An examination of state motor fuel and registration taxes reveals their peculiar value in financing highway improvement and maintenance programs. Development of improved American highways paralleled the development of registration and fuel taxes. This parallelism has not been a matter of chance. Willingness of motorists to bear substantial registration and fuel taxes, the almost complete Government allocation of such revenues to highway interests, and the approval of "reasonable" highway-user taxation by the petroleum industry are directly responsible for our unparalleled highway development. The success of this benefit tax plan suggests the possible development of a similar special tax plan for aviation.

Of course, the original reason for registration of automobiles was need for their regulation. But it immediately became apparent that here was an ideal spot for the assessment of a benefit tax. Automobiles could be taxed to help provide the badly needed improved roads. It appears that aviation in 1945 occupies much the same position. The only difference is that regulation of the automobile was developed by the states, whereas the Federal Government already virtually controls aircraft regulation and registration. The states can find little justification for requiring a duplicate state registration and, therefore, little basis for aircraft registration taxes.

One phase of our benefit system of aviation taxation, therefore, must be the assignment of registration-tax authority to *one* taxing jurisdiction, preferably the Federal Government. In this connection, it seems reasonable to suggest the levying of a graduated registration tax. Larger aircraft require more costly airway facilities, sturdier landing mats. They use a larger segment of the airport traffic circle on arrivals or departures. They require the development of tower and radio facilities. But an annual registration tax also is justifiable in the case of the occasional flyer. Much post-war expansion in airway and terminal facilities will be necessary to accommodate these private pilots who will be responsible for the peak air traffic on week ends and holidays.

But too heavy dependence on a Federal registration tax could unduly restrict aviation. Our post-war tax plan must also provide a fair means of collecting revenue from the sale of aviation fuel. Such a tax could be brought to bear on aviation directly in ratio to its use of aviation facilities—that is, the more the aircraft is flown and the larger its engines, the greater the use of airway facilities and, hence, the greater tax contribution of its operator.

At present, however, the fuel tax burden is far from being equitable. Although well over half of the states have so far refrained from taxing aviation gasoline, a number of states have assessed rates ranging from a fraction of a cent up to seven cents per gallon. And state interest in the tax is growing rapidly—as the record of the 1945 state legislatures clearly shows. Since a Federal tax is levied on all motor fuel, including aviation fuel, an additional levy by the states falls in the category of multiple taxation. Also the Federal Government has not yet adopted the policy of considering the tax on aviation fuel as an aviation user tax.



ONE-HAND CONTROL

TO REDUCE pilot fatigue and enable bombers more easily to maintain a tight formation when over enemy areas, this "formation stick unit" was developed by the Air Technical Service Command and Minneapolis-Honeywell Regulator Company. It requires only a one-pound pull and eliminates need of both pilots exerting their combined strength to maintain formation position in turbulent air.

The control, mounting a pistol-grip lever about 10 inches long, has an arm rest for the pilot and moves in all directions similar to the "joy" stick on pursuit craft. First used on *Liberators*, the new electronic control stick now is installed on all four-engined bombers, including the *Superfortress*.

Through electronic amplification and the servo motors of the control surfaces, the stick moves the controls in the same direction and proportion as the stick itself is moved.

The tax on motor fuel for highway vehicles is an appropriate user tax to cover the costs of the expanding highway facilities provided by the states. *But the states have not provided similar facilities for air transportation.* Nor are they in a position to do so. Municipalities and other units of local government have, with the assistance of the Federal Government, provided airports and other important terminal facilities used in air transportation. And landing fees as well as other rentals paid by air carriers are already making appropriate payments to the units of local government for these facilities. It seems evident, therefore, that there is little justification for special state aviation taxes.

I believe aviators and airline companies will willingly pay a heavier fuel tax only when they know that they are actually helping to build improved airway and terminal facilities for themselves. This important factor can be most clearly established when fuel tax jurisdiction and the allocation of revenue derived from the tax are made the exclusive domain of the Federal Government. Certainly the Federal Government is in a far better position to develop aviation's most frequently used facilities or most sorely needed improvements. The limited scope of state functions in aviation seriously curtails their ability effectively to expend such funds. If states were permitted to tax all aviation transportation simply to finance rather restricted state functions, the effect would be the same as if all highway users were taxed primarily to provide funds for hard surfacing alleys and farm-to-market roads, leaving the main highway systems to shift for themselves.

With a large proportion of air commerce of an interstate character and with an estimated 70 per cent of aviation fuel currently consumed for commercial purposes, the importance of Federal controls can scarcely be minimized. Under a system of state taxation, air carriers might logically demand freedom from fuel tax in a given state when the destination or point of origin of their aircraft is outside the state. Think how much fuel would thus completely escape taxation. And if Congress, in attempting to plug this loophole, should permit non-discriminatory state taxation of fuel consumed in the state, extremely conflicting jurisdictional problems would still arise. For one thing, what and how would a state tax the fuel of a plane that merely flew through the air mass when temporarily traveling across the state?

Summarizing the minimum requirements of a tax plan from which aviation itself can hope to reap the greatest possible benefit, the most direct sources for benefit revenue are from registration and fuel taxes. Jurisdiction over property taxation must, perforce, be shared by both local and state governments as at present, with some sensible and fair decision on the location of personal property for tax purposes. But no equitable arrangement can be made short of giving the Federal Government exclusive registration and fuel-tax jurisdiction.

One of three alternative methods may be employed in achieving this division of responsibility. The more direct method is for Congress to enact a law expressly prohibiting state taxation of aviation fuel and state registration of aircraft. Legally this probably could be done. In conjunction with this action, a Federal aviation fuel tax should be levied, the proceeds dedicated to aviation purposes. Registration taxes could be reserved for con-

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sideration once post-war aviation expansion is under way.

While such a rugged policy might be possible legally, Congress might hesitate to treat the states so arbitrarily. A more judicious — and less antagonizing — plan might be the levying of Federal aviation taxes without direct action with respect to state levies. The next step in this course of action would be to make Federal aviation aid to the states contingent upon state endeavor to put their tax houses in order—a move that would require the states themselves to reduce, if not actually to repeal aviation taxes. The prospect of large Federal aids could thus be used in effecting state co-operation.

That this device has already received serious consideration is evident in the recent recommendations of a special Senate subcommittee on the McCarran bill—a billion-dollar post-war airport construction bill introduced by Sen. Pat McCarran (D., Nev.). A highly controversial provision accepted by the subcommittee requires that states spend on airport development all funds derived from aviation fuel taxes and on other aeronautical fees. It is significant, too, that under the adopted bill local governments must match Federal airport expenditures of $100,000,000 annually for the five post-war years on a 50-50 basis.

A still more considerate and far-sighted method would be for the Federal Government to abandon its $5 use tax on autobiles and its excise tax on motor fuel in favor of the states. This would serve as a practical compensation for a state surrender of aviation fuel and registration taxation. This division — with aviation benefit taxation going to the Federal Government and highway benefit taxation going to the states—places promotional responsibility on the agencies that are most able to bear them. By such a tax policy, the Federal Government would become responsible not only for disciplining aviation, but also for promoting and maintaining a wholesome aviation economy. Temporary losses to the Federal Treasury would be more than compensated for if aviation tax yields increase as they give promise of doing. Even the productive motor vehicle registration tax produced only $954 in its first year.

Any one of these procedures would enable the Federal Government to deal with world aviation problems unhampered by internal strife among the states. The total result would be to break through the low overcast of indecision into the clear sky of real aviation progress. END

The Bombsight

(*Continued from page 30*)

interval. After mechanically subtracting from that total distance the trail (lag) which was also set in the bombsight from a chart, the bombsight produces a range angle. This is the angle formed between the line of sight to the target and a vertical line from the airplane at the proper instant of release.

The bombsight is basically an automatic speed and distance calculator which interprets its findings in the form of an angle. If you remember your plane geometry, you will recall that in two triangles having the same angles, the ratio of the length of the side of one triangle to the length of the corresponding side of the other triangle is equal to the ratio of another side of the first triangle to the corresponding side of the second triangle.

Now imagine the right triangle formed by the line directly beneath the bombsight to a point on the ground, a line from that point directly to the target, with the third side of the triangle formed by the line of sight from the bombsight to the target. Then imagine another very tiny right triangle within the bombsight itself created by the same line of sight to the ground beneath and to the target ahead, but bounded on the bottom by a horizontal wire. The ratio of the sides of these two triangles is identical.

In the so-called timing type of bombsight, the target is "tracked" by moving a crosswire back along this horizontal wire for a number of seconds corresponding to the estimated time it will take the bomb to fall. The crosswire is kept in line between the bombardier's eye and the target and, at the same time, a second crosswire is moving forward from the vertical point directly beneath the bombardier's eye. The two crosswires across the vertical wire look like an "H" laid on its side. The speed of the first wire corresponds to ground speed. The distance which it moves along the horizontal sighting wire corresponds to the distance on the ground over which the airplane travels during the time of tracking.

If the rear wire travels forward at the same speed as the front wire moves to the rear, and if the tracking time is equal to the time of fall, it is apparent that the rear wire will move ahead of the vertical a distance corresponding to the actual distance which the airplane will travel during the time of fall.

But that is not the correct range because trail has not been subtracted. To accomplish this, we make an adjustment. The rear wire is initially set to the rear of the vertical a small amount corresponding to the trail. It starts forward with a handicap which causes it to go beyond the vertical a distance corresponding to the correct range. Now the line from the bombardier's eye through the rear crosswire is the line of sight which should pass through the target at the instant of release. The bombardier directs the airplane along the proper course as the target and the rear crosswire approach each other. Just as they come in line, the bomb is dropped instantaneously.

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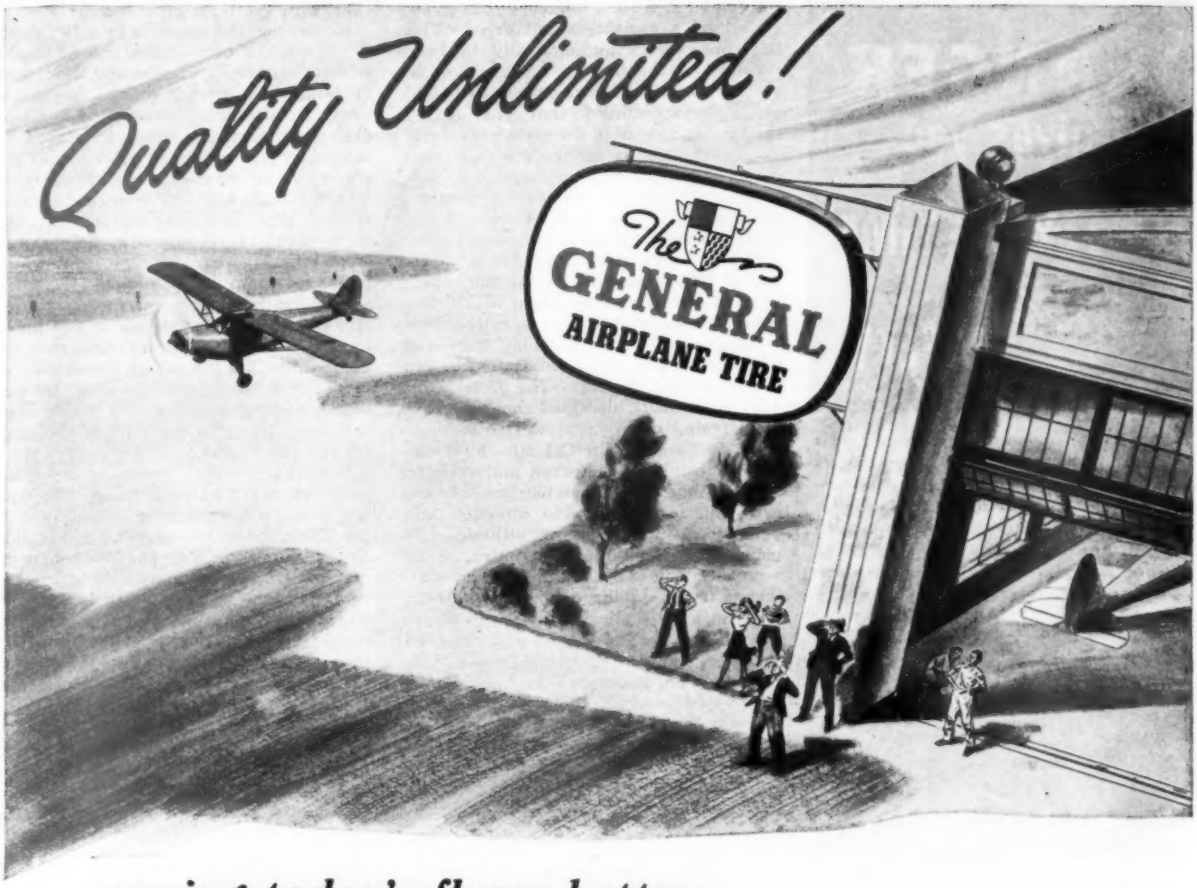

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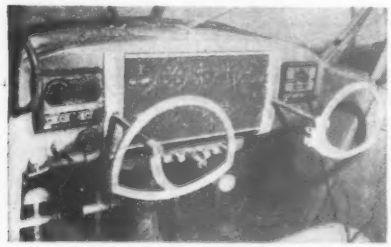

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the line of sight is a telescope, power-operated by a variable speed drive. This telescope moves automatically to keep the line on the target. The mechanism sets up within itself a release-line-of-sight angle corresponding to that generated by the rear crosswire in the sight previously described. The lateral crosswire is kept on the target, as the telescope is driven. When the telescope reaches the right angle the bombs are released electrically. While the bombs could be released manually, an interval of only one-fifth of a second at 200 m.p.h. would cause the bombs to go 60 feet beyond the point which they would hit with an automatic release.

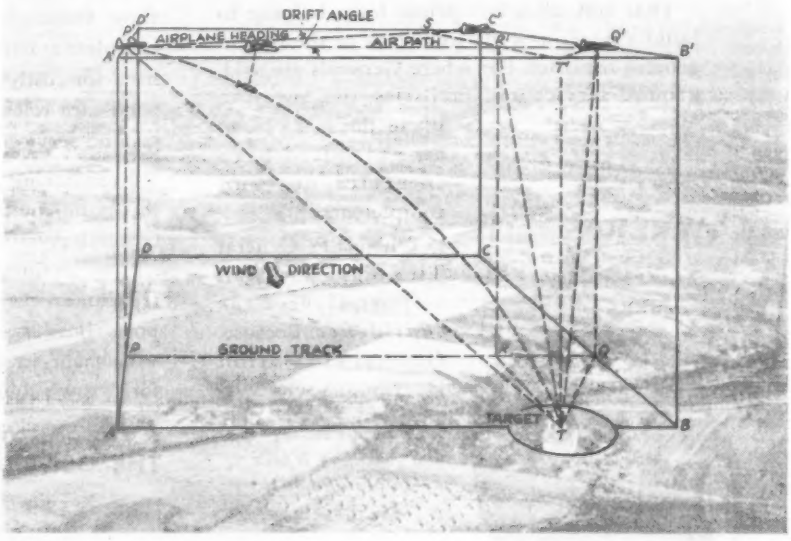
American precision bombing technique calls for a check of the bombsight before arrival at "initial point." The initial point (IP) is an easily-identified check point in the terrain, usually four to five minutes from the target. The C-1 auto pilot and the bombsight are checked and running at this time. The bombardier takes a drift run to obtain wind direction and velocity at the operating altitude. By using a modified E-6B computer, or an automatic bombing computer which is attached to the stabilizer, he can obtain the drift on any heading and also the dropping angle. He presets the data obtained into the sight to save time during the bombing run. Meanwhile he takes a final check on the target charts and maps.

The formation turns and the bomb bay doors are opened. The bombardier has previously placed all the switches and levers of his instrument in their proper position. Now, by means of the automatic pilot, the bombardier guides the aircraft into the attack heading by sighting over the trail bar. He rechecks the drift and dropping angle. It is a simple matter for the plane to be turned over to the bombardier. The pilot can turn on the auto pilot and let the bombardier know he has done so, or when the bombardier operates the bombsight clutches for bombing purposes, he automatically connects the sight into the auto pilot for the run.

As soon as the target is at a 70° sighting angle, the bombardier throws in the telescope drive clutch, starting the lateral or range hair driving on the target. If evasive action is necessary, the bombardier unclutches the auto pilot clutch (a secondary clutch) and maneuvers the plane by turning the bombsight or using a turn control knob. The degree of bank is limited mechanically by stops on the auto pilot, preventing the bombardier from making excessive banks which might break up the formation. His turns should not take the plane more than 15° off course. Evasive action is continued until the rate of index indicates that the bombardier has the pre-arranged time of bombing run remaining. This time is measured by noting the distance between the rate and telescope indices and converting to minutes.

Now the bombardier guides the plane onto the target by looking into the telescope and when the vertical hair bisects the aiming point he engages the direction clutch, thus stabilizing the bombsight directionally. He uncages the gyroscope and levels the bubble, which is centered when the gyro is operating properly, by using the two precession knobs. He places the range hair on the target by using the outside range knob. If any ground motion is apparent, he synchronizes the movement by using the inside range and course knobs. When the motion ceases the bombsight is synchronized and takes over automatically after the trigger is raised and locked. Bombs are released automatically when the rate and the telescope indices cross.

After the bombs are loosed, the bomb bay doors are closed and the control of the automatic pilot is switched back to the pilot by engaging the auto pilot clutch and disengaging the directional clutch. The bombsight is turned off and all switches are opened. The pilot takes over direction of the plane again. END



Sight corrects for drift because wind moving across ground track affects bomb trajectory.

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Can I Take Off?

(*Continued from page 44*)

We find this figure by dividing the final ground speed of the plane at take-off by the time required to reach that speed. It is convenient to express this ground speed in feet per second instead of miles per hour (see Figure 1).

CONVERTING MILES PER HOUR TO FEET PER SECOND

Miles per hour	Feet per second	Miles per hour	Feet per second
5	7.33	55	80.66
10	14.66	60	88.00
15	22.00	65	95.33
20	29.33	70	102.66
25	36.66	75	110.00
30	44 00	80	117.33
35	51.33	85	124 66
40	58.66	90	132.00
45	66.00	95	139.33
50	73.33	100	146.66

Figure 1.

Finding the normal acceleration of your plane is a simple matter if you have a stop watch that marks tenths of seconds. All you need is the time in seconds required for the take-off and the ground speed in feet per second at the moment your wheels leave the ground. You don't have to measure the distance run on the ground, since the formula will tell you that once you have the time and acceleration figures.

Your plane's acceleration will vary with circumstances. It depends primarily on the power available and, everything else being equal, the more power you have the more acceleration you will get. Sloping ground will either increase or decrease the normal acceleration, depending on the direction of take-off.

High altitudes which reduce engine power also reduce acceleration but not as much as would be supposed. The long take-off run necessary at high-altitude airports is not caused primarily by loss of engine power, but is mostly due to the low lift value of rarefied air, which requires that the plane travel faster before it obtains enough lift for take-off.

There is one factor which does not affect the acceleration of an airplane at all —the wind. Of course, wind affects landing and take-off runs to a most important degree, but the acceleration of the plane is not changed by any wind, regardless of its strength or direction. Hence, once we know the acceleration of our plane under average conditions, we can use this known acceleration to calculate the effect the wind will have on our landing and take-off runs in serving to shorten or to lengthen them.

To determine the acceleration of our plane under "normal" conditions, we shall select an average day, *with no wind blowing*, and an average field, preferably a grassy one, and shall make the gross weight of the plane correspond to the gross weight which usually accompanies us on our cross-country flights.

Open the throttle wide, start the stop watch at the moment the brakes are released and stop the watch at the moment the plane leaves the ground. More accurate results can be obtained by timing several take-offs and finding the average time.

We know at what indicated air speed our plane takes off, so we convert that reading to *true* air speed, just as we do for navigation purposes. Since no wind was blowing, the true air speed here equals the ground speed. Divide the ground speed (expressed in feet per second, not miles per hour) by the number of seconds shown on the watch and the result is the "normal" acceleration of our plane in feet per second per second. This figure should be remembered or written down for it is a constant value for that plane under the test conditions and it holds good even though the wind may be blowing.

To find the length of the take-off run we use our formula. The length of the run is represented by s, the acceleration by a, and the time in seconds by t. Then

$$s = \tfrac{1}{2}\, at^2$$

Or, the distance run is equal to the product of half the acceleration and the square of the time.

For example, a lightplane takes off with no wind at a true air speed (ground speed, also) of 55 m.p.h. and the stop watch shows that exactly nine seconds were required for the take-off. We divide the ground speed, 80.66 feet per second, by the time, nine seconds, and get the acceleration, 8.96 feet per second per second. We round out this figure to nine for simpler computation and then our distance run equals $4.5 \times 9 \times 9$, or 364½ feet.

Now in order to find out what effect a head or tail wind would have on the take-off distance run, we do not have to try it to see. The use of the same formula will tell us, since with a wind blowing, the time of take-off will vary.

For instance, with a 10 m.p.h. head wind our plane will take off with a ground speed of only 45 m.p.h., instead of 55. This is 66 feet per second. It will take our plane, with its constant acceleration of nine feet per second per second, only 7.3 seconds to reach this speed and take to the air. The take-off run would then be $4.5 \times 7.3 \times 7.3$, or 239.8

LAYING WIRE BY AIRPLANE

TELEPHONE wire can now be laid over all types of terrain by low-flying *Skytrains* at a rate of two miles per minute. The method, developed by the Air Technical Service Command in conjunction with Bell Telephone Laboratories, permits laying 16 miles of wire in one operation.

A parachute weighted with a chain (upper left) is used to pull the wire earthward through a long metal tube (upper right). A crew of two or three men feed the wire from eight boxes (lower left) coupled "in series," with each two-mile section being connected to the next one. When the lead section of wire hits the ground, a crew attaches a field phone, communicates with the plane and proceeds to establish field communications (lower right).

The Signal Corps has also been using liaison planes to lay shorter lengths of lighter wire. However, the AAF method can lay in one flight as much wire as a field telephone can use efficiently

POST WAR AVIATION OPPORTUNITIES
Bulletin

VOLUME 1 NUMBER 9

Fixed Base Operation— Its Meaning and Opportunities

(PART 1)

Fixed base operation is the subject of much postwar aviation talk. Many have heard that it is a dependable source of income and are interested in its opportunities without being aware of the exact meaning of the term or its job requirements.

DEFINITION

To begin with, fixed base operation is to aviation what the garage is to the automobile. That is, it implies a permanent terminus where planes may be hangared, repaired, fueled, etc. Accompanying activities such as radio, flying and navigation schools, charter services and concessions, such as restaurants, hotels, gas, oil and shop services, are also a part of any fixed base operation where traffic is reasonably heavy.

EXTENT

The extent or scope of such operation may range from serving the aviation activities of a progressive village to serving the largest operations in cities with important airline terminals.

Duties of the fixed base operator are varied. He may sell fuels and lubricants, service and overhaul engines, supply spark plugs, tires, propellers, flight instruments, goggles, flying suits, etc. Thus ground crewmen will be in demand for their mechanical and technical knowledge and radiomen to condition and install transmitters and receivers; bombardiers and navigators might combine their knowledge of instruments and aviation in general with sales or managerial ability. The teaching of navigation, etc., could then be either a side or a main line.

Sales department, showing the variety of parts and equipment in which fixed base operators deal. (Courtesy—Pacific Airmotive.)

Pilots will find opportunities to act as dealers for light planes with flight instruction adding income to that received from any servicing activities they may enter.

DEPENDABLE INCOME

Of interest to the prospective fixed base operator is the fact that aircraft comes under rigid Civil Aeronautics Administration rules regarding maintenance. That is, the 100 hour check is required by law for all planes —which means that operators are assured of a definite market. This market may be figured in advance with reasonable accuracy by investigating the number of permanent and transient planes which are in the habit of using the proposed site.

AIRPORT REVENUE

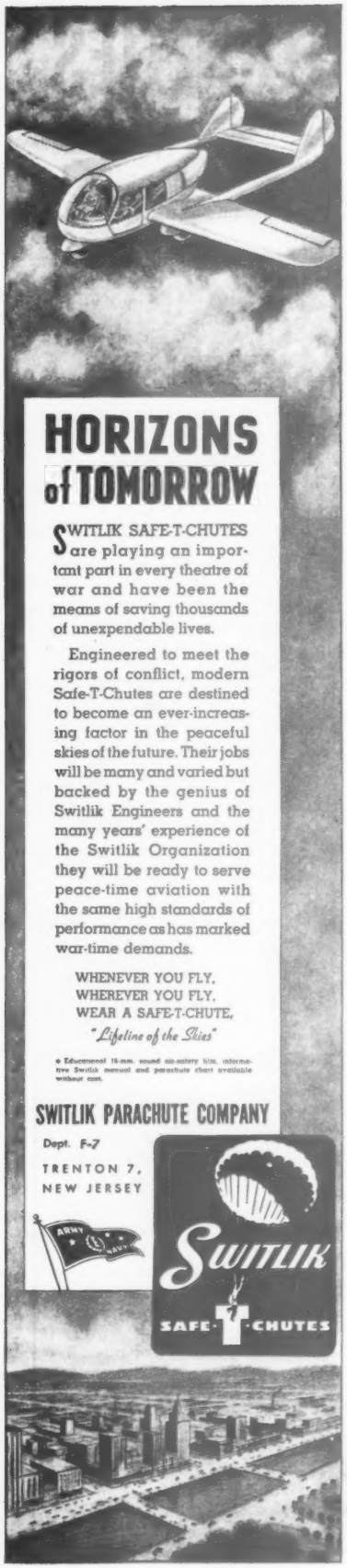
Airport revenue sources based upon a survey by the American Municipal Airport Association are valuated as follows: Hangar and storage, 25%; gas and oil, 25%; other rentals (offices, etc.), 19%; field fees, 19%; concessions, 8%; commissions and miscellaneous income, 4%.

Rentals include hangar, ground, office, factory and lockers. *Concessions* mean gas and oil, restaurants, repair shops, accessory sales, hotel shops and facilities. *Field fees* include landings, lights, commercial operation, charter services, airlines, schools, military, etc. These three items comprise the main classifications of all airport revenue.

(Note: This is the first of three Bulletins on the subject of fixed base operation and its postwar potential for members of the air forces.)

The ninth in a series of bulletins designed to acquaint ground and flight personnel of the Army, Navy and Marine Air Corps with new developments in the field of commercial aviation. Union Oil Company does not believe the war is won, but we do think many members of the air forces are wondering what they will do when peace comes. We believe they will be interested to know of any opportunities which exist for them. Inquiries are welcome, and we will be glad to furnish information to interested personnel. Address—Aviation Dept., Union Oil Company, Room 700B, 617 W. Seventh Street, Los Angeles 14, California.

AVIATION DEPARTMENT
UNION OIL COMPANY
OF CALIFORNIA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feet. Conversely, with a tail wind of the same velocity we would have to reach a ground speed of 65 m.p.h. for the take-off, with a correspondingly longer time needed to accelerate to that speed, which in turn means a longer run.

The effect of the wind is to increase or decrease the ground speed at take-off. The plane requires different times to reach these different ground speeds and these times are calculated simply by dividing the ground speeds (expressed in feet per second) by the constant figure for the plane's acceleration.

You get the ground speed at take-off merely by *subtracting* the wind speed from your true air speed when taking off upwind, and by *adding* the wind speed to your true air speed when taking off downwind.

This will let you know if you have enough runway for a take-off under any wind conditions, provided the runway surface is comparable to that surface on which you made your original acceleration determinations. Often it is not; therefore it is advisable to make acceleration determinations on sandy, muddy and grassy fields by timing take-offs from such surfaces wherever practicable. Then you can keep your data somewhat as follows:

$$s = \tfrac{1}{2} at^2$$

t = ground speed divided by acceleration

a = 10 feet per second per second on paved runway
9 feet per second per second on grassy field
8 feet per second per second on sandy field
6 feet per second per second on muddy field

Whenever necessity calls for an exact knowledge of the distance your plane will run on an unfamiliar field, just use in your calculations the acceleration figure you have determined to correspond most closely with the type of surface on the unfamiliar field. If you make a tabulation of the different ground runs that correspond to different times required for take-off, using your own acceleration figures, you will discover a startling fact: if you double the take-off time, you do not double the length of run—*you quadruple it!* And if you insist on taking off downwind in a really strong wind, so that your take-off time is three times what it would be if you took off upwind, you will be greatly and perhaps fatally surprised to discover that your take-off distance is increased *nine times.* Since the wind has a much greater influence on the length of run than is supposed, a downwind take-off can rarely be justified.

Here you will ask: "What about the slope of the ground?" We all know that a down slope would aid us in gaining speed, but just how much extra speed is gained on a given down slope?

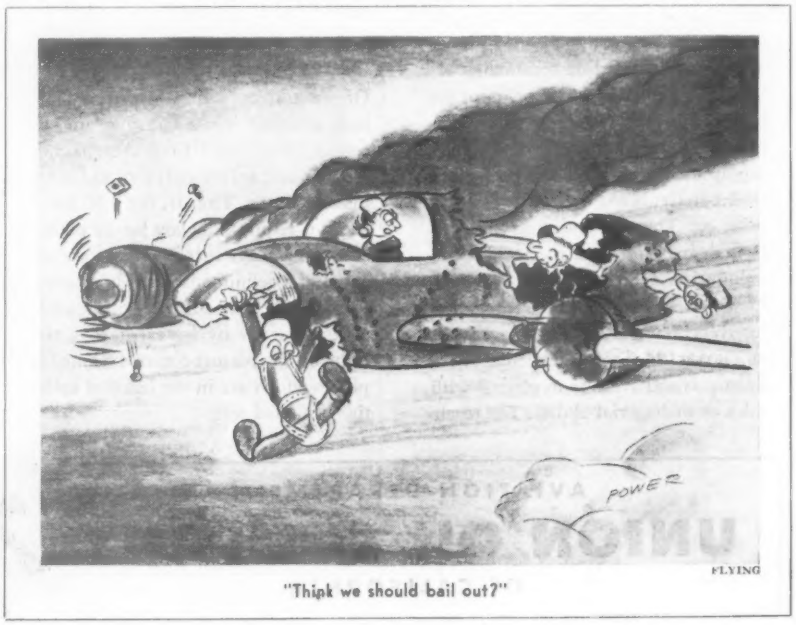
ACCELERATION ALONG A SLOPE

Per cent slope	Component of gravity along slope
1%	0.32 feet per second per second
2%	0.64 " " " " "
3%	0.97 " " " " "
4%	1.29 " " " " "
5%	1.61 " " " " "
6%	1.93 " " " " "
7%	2.25 " " " " "
8%	2.57 " " " " "
9%	2.89 " " " " "
10%	3.21 " " " " "

Figure 2

Figure 2 shows the extra acceleration you can get from gravity by taking off downhill on varying degrees of slope. If you are figuring your chances on an uphill take-off, remember to subtract this acceleration of gravity from your plane's normal acceleration instead of adding it.

A five per cent slope (which means a drop of five feet in every 100 feet of horizontal distance) will, on a downhill take-off, give you 1.61 feet per second per second extra acceleration, which would shorten your run by about as much as would your taking off into a five m.p.h. zephyr, a wind which can barely be felt



"Think we should bail out?"

Meet the Navy's Triple-Threat Star

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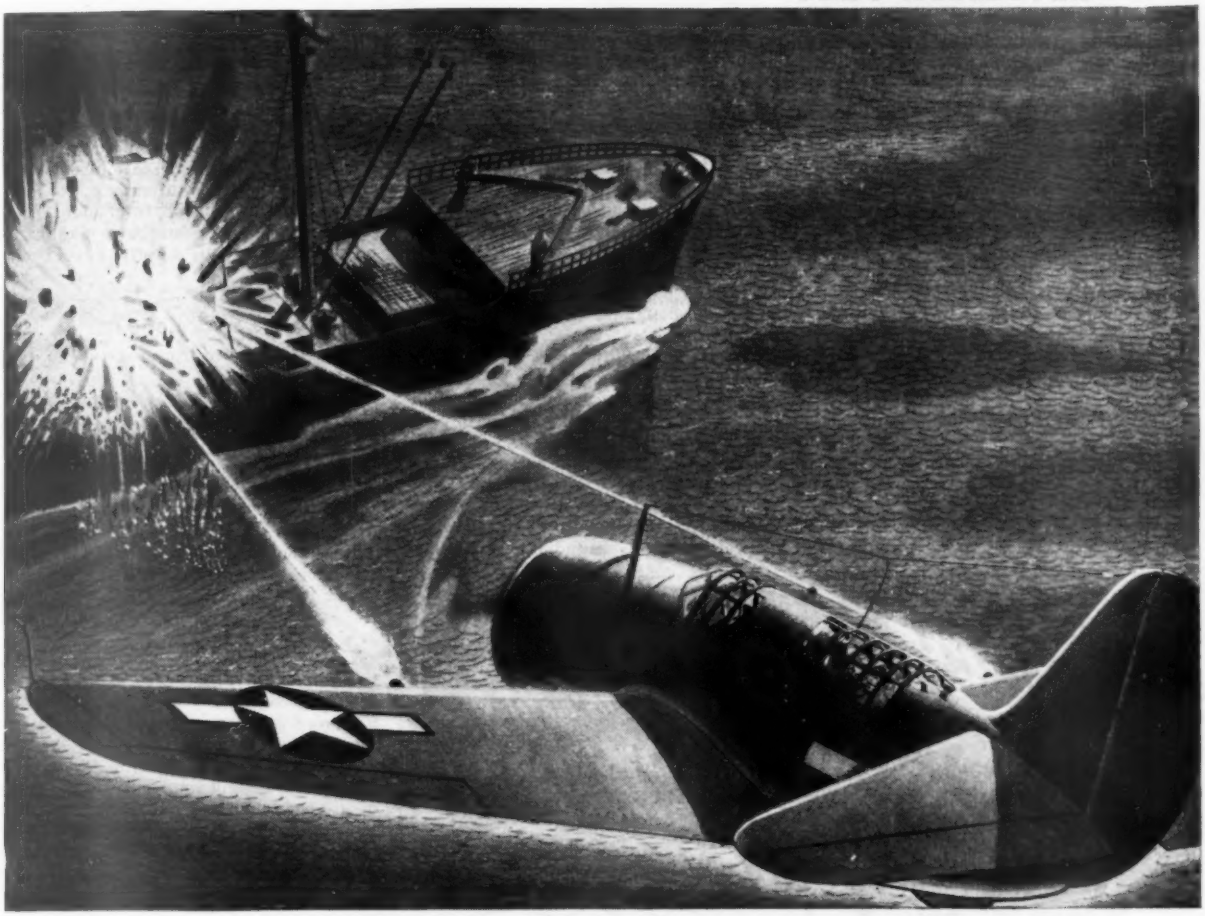

. . . scoring against the enemy with BOMBS . . . ROCKETS . . . CANNON!

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in the face. Hence, if the wind is quite noticeable, it will give you a greater advantage on the take-off than will a down slope of moderate proportions on which we usually land and take off.

Now let's see if you could use this new knowledge if you got into a jam. Through a forced landing you find yourself on a really steep slope (10 per cent) covered with heavy grass. The distance available to you up and down the hill is about 700 feet and the wind is blowing in a quartering fashion across and down the field about 20 m.p.h.

How close could you come to guessing the right answer here? Would you take off against the wind and up the slope, or with the wind and down the slope?

You know that through this kind of heavy grass your plane's normal acceleration is going to be about five feet per second per second instead of the nine it is on an ordinary field. The slope will affect your acceleration by 3.21 feet per second per second (Fig. 2).

You know it is possible for your plane to take off at 50 m.p.h. indicated air speed and that this corresponds to 55 m.p.h. true air speed when corrected for temperature and elevation of the field above sea level.

You also figure that, since the 20-mile wind is blowing in a quartering fashion across and down the field, its effective force in the downhill direction is only about 14 m.p.h. Now let's compare the downhill take-off with the uphill take-off as shown in the adjoining columns.

	Uphill take-off	Downhill take-off
Ground speed with wind		55 + 14 = 69 mph. or 101.2 ft./sec.
Ground speed against wind	55 − 14 = 41 mph. or 60 ft./sec.	
Total acceleration	5 − 3.2 = 1.8 ft./sec./sec.	5 + 3.2 = 8.2 ft./sec./sec.
Take-off time (ground speed divided by acceleration)	$\frac{60}{1.8}$ = 34 seconds	$\frac{101.2}{8.2}$ = 12.3 seconds
Take-off distance ($s = \frac{1}{2}\ at^2$)	1,040.4 feet	620.3 feet

You can't get out of the field in the uphill direction but the downhill take-off will be possible since the field is 700 feet long. The above example is exaggerated, since a lightplane that can climb only 500 feet per minute at about 57 m.p.h. would have an angle of climb no greater than the 10 per cent slope and therefore it couldn't get away from the ground if it took off up this degree of slope.

There is one question you are sure to ask at this point: how do you measure degrees of slope and wind speeds out in the country?

While practice with a clinometer on different slopes will enable you to estimate slopes with some accuracy, perhaps your most practical solution is to carry in your plane a small pocket level and a metric rule and determine the slope by the method illustrated.

As for wind speed, your most accurate method would be to set up two tall sticks vertically into the ground at a known distance apart and with your stopwatch time the passage of a puff of cigarette smoke between the two sticks. For winds too strong to be timed properly with smoke, use instead a small piece of the cigarette paper. In any case, use the average of several measurements.

Application of these fundamentals of "airport arithmetic," wherever you might be, will answer your question—can I take off? END

Can I Land?

(*Continued from page 45*)

cessfully for a good many hours by the writer, who is now instructing Royal Air Force pilots at Falcon Field, Ariz., consists of these words of wisdom:

"When you suddenly see the ground tilt upward at a sharp angle, start your hold-off."

It seemed to work in most cases. Fewer students were flying into the ground, fewer leveling off sky-high. With average aptitude they could carry on through to a safe landing.

The writer, aided by a fellow instructor, Robert N. Elliott, Jr., a graduate of M. I. T., began an investigation which produced the facts and charts accompanying this article.

As Langeweische says in *Stick and Rudder*, you don't land an airplane with depth perception, utilizing bifocalism to triangulate your height above a given point. You do the reverse, and could do it with one eye. You simply gauge the angle between two points on the ground and from that angular measurement estimate your height.

First, look at a distant point on the landing runway, then at a closer point. In dropping your eye you should automatically measure this angle and memorize it. When you repeat the process lower down the glide path, you see that this angle has changed, and that you are closer to the ground. It's simply putting perspective to work and associating these angular changes with altitude changes.

Here's how to apply it. Assume that you start your glide from a satisfactory "key position" that you know from experience will take you down a normal glide path to the near end of your runway. Start the glide around 800 feet, dropping the nose of your aircraft to an attitude that will give you a normal gliding speed. Just above your plane's nose —this point varies with different craft— you see the near edge of the runway. Let's say the runway measures 1,000 by 50 feet. By experience you know your

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plane's gliding angle under ideal, no-wind conditions in relation to the ground. Assume it's 10° (average for lightplanes), so the near end of the runway will be 10° below your horizon which always stays at eye level. The near end of the runway consequently stays put at 10° below your horizon, at any altitude. We'll call that point our *glide terminus.*

As you glide toward it, the terminus spot enlarges in the field of vision but doesn't do much else. You could keep on watching it enlarge until your nose pushed through your altimeter, which is what probably would happen if you didn't look somewhere else for a while.

You might look off in the distance, and this actually would help. Let's pick a point 1,000 feet distant from the glide terminus, at the runway's rear end. We're going to need at least two reference points, anyway, to make perspective work. While our terminus point has been remaining just 10° below our horizon all the way down the glide, what about the *far* end of the runway? From our 100-foot elevation down to the ground, the distant point seems to move uniformly toward the horizon at a rate of about ½° for each 10-foot descent.

Because our terminus stays at 10° the angle between the two points *increases* steadily until we're at ground level, when the angle theoretically becomes 180°. And because (we hope) your eye never gets clear down on the ground, we get no significant perspective change to tell us anything useful.

If we don't want to look at the glide terminus on the way down (except to locate and identify it), where do we want to look? We see from Curve A on the graph that the angular distance between a point 500 feet ahead of the glide terminus and the end of the 1,000-foot runway gets smaller and smaller right from the start of the glide. Why does this angle shrink when the angle between the terminus and the 1,000-foot point grew?

The answer is simple: the 500-foot point, being closer to you than the far end of the runway, moved toward the horizon more quickly than the 1,000-foot point. The terminus point didn't move at all, hence the angular increase. Curves B, C, D and E of the graph show that the shrinkage effect does not take place at around 100 feet altitude or above, if you are looking at the ground much closer than 500 feet ahead of the glide terminus. Because we are looking for a change from an opening to a closing angle, we can evolve a rule here and say—look at a more distant point on the runway during the "high approach." There you will see a change of perspective that tells you roughly how fast you are losing height.

Drop the eye to a point 50 feet or so ahead of the glide terminus and see what it does. Examine Curve D on the graph. At 100 feet of altitude, our 50-foot point and our 1,000-foot point seem to be about 5.75° separated. As we glide in, the distant point moves toward the horizon more quickly than the closer point, and the angular spread between them increases to 6.5° at around 40 feet off the ground. But now something strange begins to happen. Instead of moving steadily apart, the two points quite suddenly *jump together*. The whole picture changes in a flash, and our nearby reference point scoots horizonward in a hurry. This change occurs at between 40 and 30 feet above the ground,

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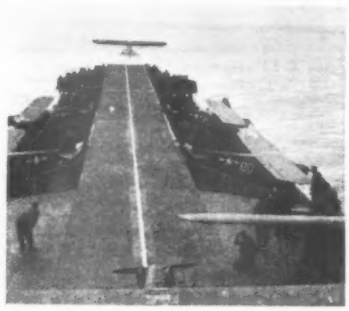
Total plane capacity is not definitely known but seven craft are visible in the picture at right. The white line aids the pilot in keeping the plane straight during take-off.



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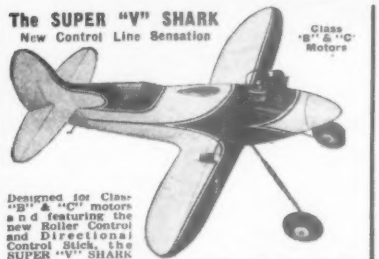

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if we are looking about 50 feet ahead of our glide terminus.

If we look at the ground only 25 feet ahead of the glide terminus, the "break" in perspective happens between 30 and 20 feet off the ground. The closer to the glide terminus we look, the lower down this critical altitude moves. It will, of course, vary should the glide steepen due to wind effect. The more steeply we glide, the higher the critical altitude moves.

This fact explains why many an instructor's hair is prematurely gray—why students almost invariably want to level off too high while gliding in a strong headwind, in which the gliding angle is automatically steepened, perhaps to 15°. This means that although the glide terminus has dropped to 15° below the horizon, or somewhere under the nose of the aircraft, the student pilot, used to looking *over* the nose on a normal glide, during his steep glide into the wind, sees a point on the runway from 50 to 100 feet ahead of his actual terminus when he should be looking closer to it.

Let me take issue with an old CPT axiom: "In general, if the student looks at the ground too close to the airplane he will tend to level off too high and make a stall or pancake landing; if he looks at the ground too far away there seems to be no need for haste and consequently he will fly into the ground or make wheel landings."

From what has been outlined here, I suggest that the reverse is true. The farther away we look, the higher the sudden break in perspective occurs. If the student were looking at the ground *too close*, he would not see the break until *too late;* if he were looking at the ground *too far away*, he would see the break *too soon.*

When a student finds himself looking at the ground too far away because of a strong wind that steepened his glide, he sees the familiar perspective break at 40 feet or higher and things generally tell him he is only 20 feet off the ground. Back comes the stick and he makes a perfect three-pointer—20 feet too high.

Pilots flying aircraft equipped with flaps do not experience this phenomena normally, because as they drop their flaps they change to a nose-low attitude, and in looking over the nose their eye sees the runway closer to the glide terminus.

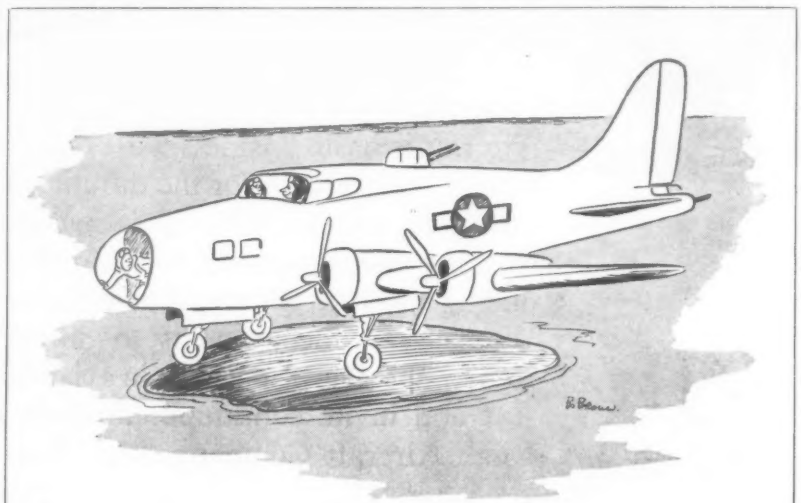
A low, flat glide, typical of a power-on approach, means that our terminus is going to be closer to the horizon—five degrees below it for a five-degree glide path. Thus altitude will be harder to judge on this type approach. By looking over the nose we see a point on the runway much farther away, and this is where we should look. The critical perspective break may be seen at around 20 feet off the ground if we look approximately 100 feet distant.

This truism results: The flatter the glide, the farther away from our terminus we should look if we want to start the level-off at the same altitude. The steeper we glide, the nearer we should look. This, of course, is a generality. Planes of higher wing loading need more altitude to flare out from a glide. The perspective change at 40 or 80 feet is not as abrupt as it is at 20 feet but it is there, nevertheless, if we look in the right place for it.

Cross-wind landings do not alter the changes in perspective as seen when gliding directly into the wind. Whether the pilot corrects for drift by crabbing or by dropping a wing, the appearance of the runway will not change from its normal appearance as long as the angle of glide is constant.

Should the glide angle change—and it often does—due to gradient wind or eccentricities of the pilot, the perspective would of course change also. A sudden steepening of the glide should be compensated for by looking closer to the terminus, and a flattening of the glide would make it necessary to look a bit farther off. The ability to hold a constant glide angle, with throttle, flaps, or other means, is therefore helpful to accuracy in judgment of landings.

One significant point emerges from this analysis. The perspective change



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from an opening to a closing angular spread will uniformly appear at about 1.5° above the glide terminus, irrespective of the gliding angle. The *rate* at which this change occurs is the tip-off that tells us how high we are. It is a slow change at 80 feet, a more rapid change at 40 feet, an abrupt change at 20 feet, and so on. While the pilot of a "grasshopper" plane has an easy time of it—he sees and recognizes a quick, sharp break at 10 feet—the airliner captain must train his eye to catch the more gradual change he will see farther down the runway which tells him he is approximately 80 feet off the ground.

This article makes no attempt to cover the other essential phases of the landing—the flare-out, the hold-off, the touchdown and the landing run. Once the landing is begun correctly, it will be easier to follow through.

A final word on the follow-through after checking the glide: once leveled off close to the ground, watch the runway at about the nearest point ahead of the aircraft where the ground isn't blurred. Don't stare at one spot but let your field of vision encompass the whole runway, including the horizon. The greatest change in angular distance between any two reference points occurs nearest the ground, so any small change in height reflects itself in an immediate and corresponding change in apparent distance between the points.

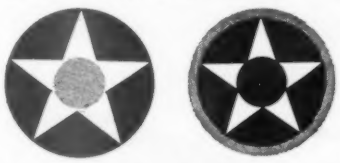
If you don't believe it, try a few knee-bends or jump up and down a couple of times out on the edge of the airport and watch perspective at work. END

INSIGNIA EVOLUTION

THAT white star on a blue field, with the white bar bordered in blue extending beyond the star tips, identifies our military aircraft. The

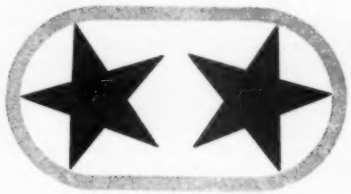
emblem shown above is the result of scientific development.

Pilots in the European area were the first to complain of difficulty in distinguishing between our old star in a circle (below, left) and the



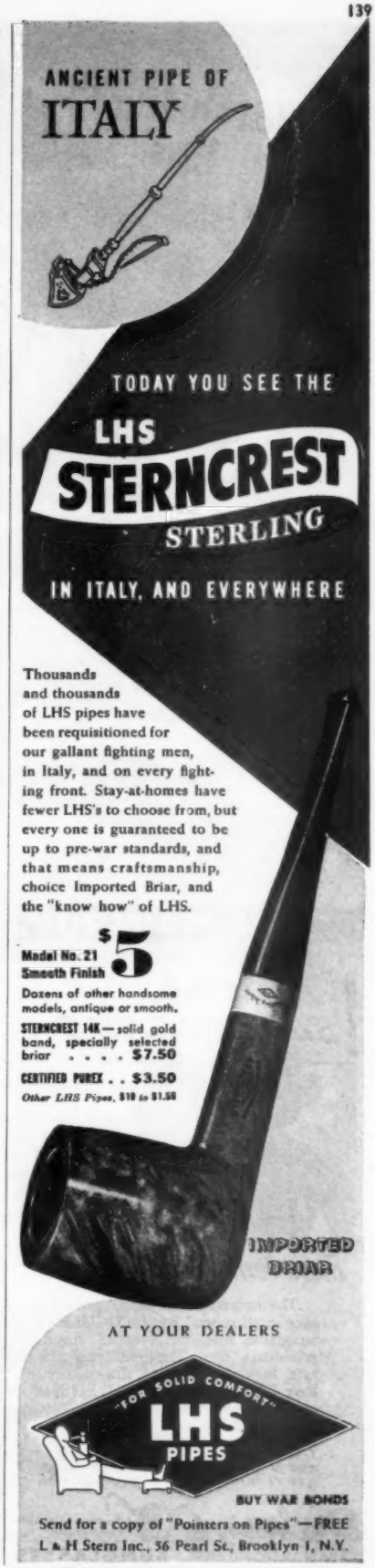
German cross, the Italian fasces on a solid field and the British circular insigne. A plea was made for an official change of design and, for expediency, a yellow circle was placed around our insignia (above, right). This was soon changed to a solid white star with the red and blue complementary colors removed entirely. It was used until the AAF developed the present insigne identifying our military aircraft.

First designs tested by the AAF Proving Ground Command at Eglin Field, Fla., incorporated our national colors, such as a single blue star (above) bordered by a narrow band of white and red and later, two blue stars on a white oval rimmed by a red band (below). These were rejected and the prototype of our current design took form as a white star on a circular blue field edged in red



(above). Objections resulted in a blue border replacing the crimson one and final approval was given.

Photographing aircraft aloft with the varied designs determined the distance at which the insignia became blurred. The present insigne blends the horizontal star points with the white bar and appears as a solid continuous band which fades to a long, thin line at maximum visual distances. All dimensions of the current insigne are based on their proportion to the diameter of the circle enclosing the star (*not* including the border). Thus, the length of the white rectangles forming the bars is .5 of the circle diameter, the rectangle depth is .25 and the outer border .0625. Our bar and star can be distinguished 25 per cent farther than the old emblem when compared with the German cross and 50 per cent farther compared with the Japanese red disc.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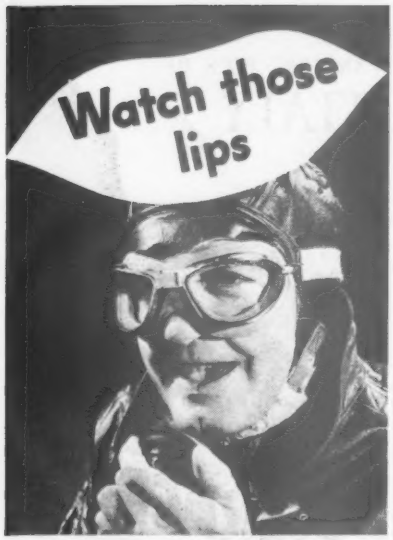

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CLEAN VISION SUNGLASSES

Fighting Laboratory

(*Continued from page* 58)

Major Clasen's squadron, first to start the dive-bombing experiments, specialized from the beginning in "clean" diving. A squadron led by Maj. (now Lieut. Col.) J. P. Haines became expert in approaching a target with dive brakes on. A third put the accent on skip bombing, a fourth on bombing at the end of a glide.

Upon the activities of these latter two hangs a tale typical of the kind of work the group did. Tactics for the new activities had to be worked out in combat, as did all technical changes necessary to convert the *Corsair* from a fighter to a multi-duty—and extremely deadly—combat craft.

The changes were surprisingly few considering that the *Corsair* had not been designed for any type of bombing. Front-line fighting laboratory practice had proved that the fighter could not lose efficiency when carrying bombs. Without loss of efficiency in any department, the squadron went in, dropped their big stuff, then revisited the target to strafe. Taking off with a heavy load of bombs—something that the pilots had regarded with high skepticism—proved no problem. Eventually three racks were used, capable of carrying one 1,000-pounder each, and the sturdy *Corsair* cruised to the target at 10,000 feet without so much as breathing hard. Two-thousand-pound bomb racks were also improvised from junked *Liberator* racks. Heavier strafing and dog-fight armament was recommeded and installed.

These problems licked, the Group turned its laboratory spotlight at the jack-pot question—how to get at the enemy with the most devastating effect regardless of his defense. That's where the skip- and glide-bombing came in.

On island after island in the Pacific, the Japs had built concrete magazines 20 feet high and from 30 to 36 feet long in which they stored their high explosives. Knocking these out not only made a hell of an unhealthy explosion, but accentuated the Jap supply problem.

There were two things wrong with these installations from our viewpoint: their pinpoint size and the thickness of their walls and roofs. A direct hit on the roof was ineffective. The group experts studied a captured magazine and discovered the reason—the roofs were made of 54 inches of reinforced concrete. The walls, it was found, were only 24 inches thick. It was therefore decided to do a pin-point 1,000-pounder skip-bombing job and see how the walls could take it. This, too, was ineffective. Once a bomb hit the ground it did not have enough force on the bounce to penetrate the magazine wall.

Maj. D. D. Irwin, a veteran of Guadalcanal, led his squadron in a new bit of test-tubing—hitting the wall direct. The difficulty of this may be gathered from the fact that his target could be encompassed by a circle a little more than 30 feet in diameter as contrasted with the dive-bomber training circle in the U. S.—diameter 200 feet. But after a little practice Irwin and his boys began getting direct hits.

This introduces another interesting scientific problem that the boys in the test-tube licked. Suppose you did get a direct hit and it worked—would you get caught in the explosion? A time fuse was put in the bombs to offset this danger. How many seconds it gave the *Corsairs* to get out of the range of the explosion is a military secret but, as Colonel Freeman remarks drily, "It seemed like a couple of hours the first time—and boy! what a pretty sight the magazine made when it blew its top!"

A squadron under the command of Maj. Grant Metzer specialized in glide bombing. Gliding slowly with flaps down, they could come down to a lower release point—300 feet instead of the usual 900 or 1,000—and still recover from their dive.

Glide bombing, a modified form of dive-bombing, was found particularly effective where the pilot had to be coming in right over the target for his released bombs to hit. The speed of the dive-bomb run is so great that no alteration of course can be attempted, but for gun emplacements and similar targets the glide was more effective. Planes came in on the target at reduced speeds, enabling them to change course without pulling out of the dive and starting over again—the only effective way they could bomb small objects.

Team play was worked out with the Navy after a dive-bombing. The Marines would pull out, rendezvous with the Navy dive-bombers upstairs, and come back in, strafing and acting as fighter escort.

Corsair armament modifications include this version using four 20-mm. cannon.

Each Marine squadron was assigned one particular type of attack for experimentation and once it had eliminated the errors the information was passed on to the other squadrons. In this way, although each squadron had its own specialty, it knew how and when to use all types of bombing tactics. On a mission, tactics might include everything, each squadron performing in its specialty. Again all squadrons might employ only

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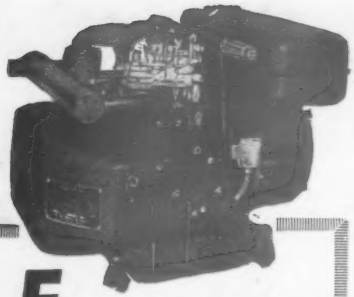

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one type of bombing for the target.

The Group went to town from then on in. In the first 11 months after the initial bombing experiment at Roi, squadrons made more than 8,000 bomber sorties, mostly against pin-point targets too small for area bombing. On most of the sorties they returned after bombing to strafe the target and, on rare occasions, engaged in some combat before going home.

Other outstanding squadron leaders, most of them still in the Pacific, were Maj. H. B. Hooper, Maj. (now Lieut. Col.) E. H. Vaughan, Maj. J. Frank Cole, and Maj. J. B. Moore. They are still keeping charts on the results of their work and a steady stream of technical reports comes from them to GHQ in Washington. Some months back they went to work with incendiaries improvised from belly tanks and filled with jellied gasoline for a total weight approximating that of a 1,000-pound bomb. From these first incendiaries—"we took one town completely off the map," says Colonel Freeman—developed those now being used with such devastating effect against Japan.

Three technical problems were solved during these experiments. The belly tanks tumbled badly when released. The problem was licked overnight by improvised fins made of plywood, sheet metal, and/or 2,000-pound-bomb tail fins. A method was also devised to perfect a sharp release of the belly tanks so that aim could be more accurate. Handling, storing and mixing the jellied gasoline was a ticklish problem which the group also helped solve.

The group now is test-tubing advanced rocket techniques and new armament. Fighter-bomber techniques which they developed have been passed on to scores of similar Marine and Navy squadrons, many of which have already gone into action, the most notable being the fighter-bomber squadrons of the First Marine Air Wing, which recently distinguished itself with MacArthur in the Philippines. END

Air Force for Sale

(*Continued from page 23*)

30,000 customers have been developed fairly simply. In addition to public announcements, each eligible institution receives a notice explaining the regulation. Also enclosed is the price list of equipment which will probably be available, together with an order blank and an agreement to be signed and notarized, under which the property may not be resold except as scrap metal.

With this precaution, plus the requirement that equipment bought "be used only for non-flight instructional, research, or experimental purposes," the regulation effectively prevents the material from returning to the commercial market. As orders come in—and at those prices they should come in fast—master lists will be prepared for each region showing how many planes, engines, and miscellaneous parts are wanted by schools in that region. Then, as material in regional storage depots is declared surplus, each applicant institution within economical shipping distance, wanting that type of surplus, is notified and asked if it will accept delivery. Shipping charges are paid by the buyer, although the RFC has everything packed and crated for shipment. As increasing amounts of equipment are warehoused, they will be spread carefully over the country so that final distribution will be on a fair geographic basis. Although not everything on the present list is yet available, it is expected that almost all educational demands will be filled eventually. From time to time the list may be enlarged.

There is a great deal of aircraft surplus now overseas that probably will not be worth the return shipping space it would take. U. S. schools abroad, such as Yale-in-China, will get their share of surplus from our foreign depots. The Foreign Economic Administration will handle distribution and sale of surplus abroad.

Educators have done considerable theorizing lately about teaching for the air age. Plans include almost anything from revising all textbooks from the first reader up, to teaching older pupils enough about flying to get them instrument ratings. As President A. C. Willard of the University of Illinois points out: "No industry makes such broad demands on so many fields of human knowledge as aviation. These demands range from astronomy and physiology to sociology and zoology; from medicine to engineering; from agriculture to commerce; from law to business management, and include nearly all the sciences. In no other field of technology is the relation between the machine and the human being so intimate and so important. Any comprehensive program in higher education related to aviation must be designed to utilize as many existing departments as possible."

Only 400 of 1,250 schools recently surveyed by CAA offered aviation courses. The courses "ranged from four- or five-year courses in aeronautical engineering to summer school offerings in aviation for elementary school teachers. A large number of the schools offered aviation ground school courses, which ordinarily include units in air navigation, meteorology, general science and operation of aircraft, and Civil Air Regulations." Now, with vast quantities of surplus aviation property soon to be available at nominal prices, it should be possible for anyone to get aviation ground school courses and mechanical training free.

So far, two-thirds of the value of all our surplus war property is in aircraft. The chances are that the great bulk of our many millions, perhaps billions, of dollars worth of surplus aeronautical equipment will be "commercially unsaleable," and so available for schools. Some of it will be brand new, surplus because it is obsolete. Seventeen basic changes of design in four years, for instance, mean a lot of obsolete P-40's. And with enough spares allowed for each plane so that if all were assembled our air force would grow by 20 per cent, warehouses would

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Studebaker Weasels help pace the drive to Tokyo

LET'S read what they said about this amazing new personnel and cargo carrier in a Philippines dispatch to "Yank," the U. S. Army weekly. Here's the quotation:

"The Weasel is still getting to the front in this tough sector after every other type of vehicle has bogged down in the rice paddies and swamps ... To the infantrymen stretching one day's rations to three, the sight of these little jobs, churning through the bog past swamped trucks, is a fine and heart-warming spectacle."

Designed by Studebaker engineers and built in the Studebaker factories, the Weasel finds footing on all kinds of terrain—sand, snow, mud, swamp or solid ground. It clambers up and down steep, slippery banks and takes to deep water like a boat, propelled from shore to shore by the movement of its flexible, rubber-padded tracks.

Power plant of the Weasel is the brilliantly responsive 6-cylinder engine of the remarkably economical Studebaker Champion motor car.

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fill up with obsolete engines, landing gear, superchargers, rudders, ailerons, stabilizers, propellers and so on, indefinitely. There are more than 600,000 different items of spares stocked by the air forces.

Then there will be quantities of property that were used in air forces aviation schools which have closed down or have reverted to their civilian program. Engines used in these schools, for instance. As civilian training schools close down their military operations, they will be allowed to buy any equipment not needed in other military programs.

Some planes fall in the "commercially unsaleable" category because they are not fit for civilian use. By May, 1945, the CAA had type-certificated only 120 of the hundreds of military models produced. Combat planes are too fast, too expensive to operate and just plain dangerous for your Central City Airport. Surplus combat planes will not be sold abroad after the war. The few that can be used by our Allies are allocated through the Munitions Assignment Board.

Transports are an example of oversupply for the civilian commercial market. Some of them will certainly be maintained in a military reserve. But U. S. plants have already delivered more than 20,000 transports for Army, Navy and Lend Lease. The cost of reconditioning a *Skytrain* and of converting it into a luxury passenger liner is only 10 per cent less than the cost of a new and more modern one.

Most experts agree that it would be a mistake to handicap either the aviation industry or the air forces by failing to take full advantage of the new regulation. "Use of surplus equipment for these purposes," the Harvard Business School report points out, "should be encouraged to the maximum extent. The indirect benefits to development of United States aviation can be great, the cost to the Government would be negligible, and a glut of serious consequence to our aircraft production potential can be minimized."

Space will probably be at more of a premium than money when it comes to providing for aeronautical education in a school. A complete plane will take up more room than a 40-pupil classroom. Components are more generally useful for ground teaching purposes than are airframes. Where a whole plane is out of the question—barring the lucky acquisition of a surplus Quonset hut or portable hangar—a school might have enough room for five or six engines and many instruments.

A compact, small-scale program can be laid out. This hypothetical order might be placed by a high school in a city of 20,000 to start an aviation engineering course:

Four engines at $10 each—one radial, one in-line, one opposed and one "V."
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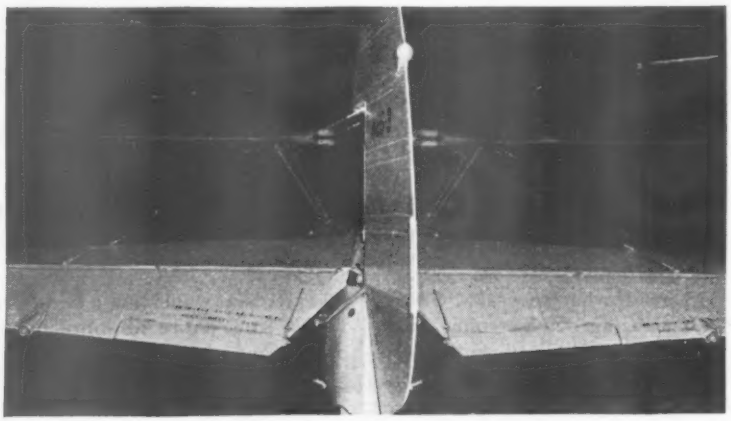
A supercharger at $13.
Hydraulic equipment from $1 to $15.
Landing gear at about $5.
Some airframe parts at from $1 to $3.

For an example of what public school



TRIPLE TAIL LIGHTS

TWO fixed red lights and a single white blinking light now aid Navy primary flight students to judge their distance at night from the plane in front of them.

The novel tail light arrangement was adopted as a safety measure for night flying at the Naval Air Station, Glenview, Ill. Two colored lights are installed, one on the trailing edge of the elevator near the outboard tips, known as "steady lights," and the white rudder light which blinks.

The new addition eliminates what is termed "auto-kinetic movement" of a steady white light, which will appear to move about if stared at too long. With as many as 100 planes in the traffic pattern at one time at night, the safety measure appreciably reduces the night flying hazard. Installation of the safety tail lights, which may be adopted at other stations, requires only 25 man-hours, or the services of a three-man crew for one eight-hour shift.

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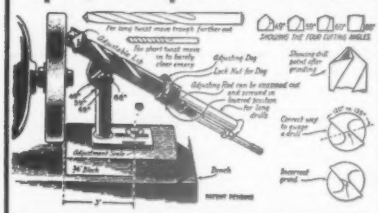

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7th WAR LOAN

aviation training can be, there is the Shelby County School of Aeronautics. A vocational school for adult training at Whitehaven, Tenn., it was one of the first to participate in the defense training program in 1940. Since then, with its equipment augmented by Army loans, it has trained thousands of men and women for jobs in aircraft production and maintenance.

Its course varies in length, according to the student's objective. These subjects may be studied:

1. MECHANICS: assembly and disassembly; fabric, paint and dope; cable splicing and rigging; sheet metal; hydraulics; electricity; welding; radio.
2. ENGINES: overhaul, tear-down and clean-up, assembly, test, installation.
3. ACCESSORIES: carburetors, generators, magnetos and starters overhauled and calibrated.
4. PROPELLERS: all types overhauled; electro-plating.
5. INSTRUMENTS: electric, gyroscopic, optical and mechanical instruments overhauled and calibrated; installation line service.
6. MACHINE SHOP: machine operation; tool and die making; bench work.
7. INSPECTION: materials; manufacturing processes; blueprint reading and sketching; magnaflux and X-ray; use and care of precision instruments; parts.

Aviation courses recommended for high schools by the California bulletin include aircraft structure, aircraft engines (including propellers), aircraft metal work, aircraft woodwork, aircraft electrical works, aircraft hydraulics, aircraft instruments, aircraft drafting and aircraft controls.

In addition to straight mechanical courses on the high school level, there will be courses in colleges on aeronautical engineering, aerodynamics, aircraft detail design and others made possible on a large scale by the disposal program.

So far, the difficulties of insuring fair distribution and of protecting existing flying schools appear to have impelled the SPB to limit property affected in the new regulation to non-flight use, even though many of the planes will be flyable. But as the number of surplus planes piles up—at about $10 a month storage charges each—it is likely that a future regulation may permit sales to schools of planes for flight use.

Illustrative of the pressure which will be brought to bear on this point is a state bulletin containing a report of the California Aviation Education Conference. The conferees voted that "The value to the nation of pilots who are trained at least to the level of private certificates is so great that the committee believes that the Government should be urged to make available to junior colleges surplus training planes no longer needed for war training purposes." Note the reference to training, not combat, types.

In its study of the surplus aircraft problem, the Harvard Business School (which made the survey for the Army Air Forces) recommends that "Specific plans must be made regarding distribution to private aviation trade schools as well as private non-profit educational groups and public institutions. It is clear that unless equipment is made available on some equitable basis to all these groups, the resulting discrimination can well be branded 'unfair.'" END

London Letter

(Continued from page 50)

ator may challenge the government's right to stop him operating on a route for which he was licensed.

Scottish Aviation, Ltd., of Prestwick, announces fares as if no proposal for a recasting of British lines had been made. Examples: Prestwick-New York (single £47, ($188). Paris £5.14.6. ($22.90). Sturdily independent Scotsmen are indignant at the suggestion that Scottish operators should be closed down.

But Lord Swinton's proposals were well received in the House of Lords and fairly well received in the newspapers. *The Times* puts all its weight into supporting them.

Civil Aircraft

Two plans for new British transports which will be realized (as opposed to design dreams) are for small feeder line and general purpose machines by the de Havilland Aircraft Company and by the Miles Aircraft Company.

The Miles M-60 is to be built to the requirements of a committee presided over by Lord Brabazon of Tara (former Minister of Aircraft Production). Fourteen passengers, a crew of two and a range of 1,000 miles are specified.

The new de Havilland is to be called the *Dove*, is to carry 11, has a tricycle chassis, and is powered by two *Gipsy Queen* engines. Its airscrews will give reversible pitch braking. Both planes will be all-metal.

Meanwhile the *Tudor II*, which will be a big improvement on the *Tudor I*, is expected to be in flow production early in 1946. Production of the Vickers-Armstrongs V-C 1 (*Wellington* geodetic wings and a new fuselage) is to begin in 1946.

The Blackburn company frankly states that its project for a 310,000-pound flying boat is only a project. Designed by Maj. J. D. Rennie, it will take 160 passengers and 30,400 pounds of freight and mail 2,500 miles.

I add a crack which caused a chuckle in pubs and clubs where flying men foregather. An experienced commercial aircraft captain, when he was shown the *Lancastrian* adapted for peacetime transport duties, said: "Slightly modified it might make a good bomber."

V.C.

The Victoria Cross is Britain's equivalent to the United States Congressional Medal of Honor. Founded by Queen Victoria, it is the supreme decoration for bravery in the face of the enemy, a crimson ribbon bearing on it a miniature bronze cross. One hundred and thirty-four have been given in the present war, 23 of them won by airmen. END

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Letters

(*Continued from page 82*)

something like *Nemesis*, how many people would interpret the latter as "retributive justice"? Names do mean much and I think we've picked the right ones.

BILL SAMUEL

Trenton, N.J.

QUERY ON JET PLANES

Sirs:

In the many articles which I have read on jet planes I have not seen anything explaining what would happen if one ran into a rainstorm, snow or sleet. Would this affect the performance of the plane in any way? Would it be possible that the rain would be mixed with the flame after being taken in through the air intake?

TOM GISVOLD

Stanley, Wis.

● Rain, sleet or snow will not affect the performance of the jet engine so far as is known. It may even be beneficial since the cool rain is easily transformed into steam by the intense heat of the engine. Steam is easy to compress and provides additional thrust. Jet experts at Wright Field point out that little trouble is expected even from dust and sand storms, believing that the dust and sand particles will readily be expelled through the exhaust—ED.

A CENTURY-OLD PREDICTION

Sirs:

While the bombardment of Tokyo is a news item that flashed across recent newspapers, it was scooped by J. K. Friederich who predicted this event a century ago. Friederich, a now-forgotten Franco-Prussian publicist interested in steam and balloon inventions, wrote a satirical account which was published in 1847. He stated that within 100 years Tokyo would be destroyed in a few minutes by bombs, rockets and gunfire from an "imperial American airfleet". While his picture of the small lightplane of the day was somewhat far-fetched, he further revealed that future aircraft would be equipped with 24 guns and would attain a speed of 235 m.p.h. He predicted that the first airship would be invented in 1891 (the first to fly was Giffard's, in 1852). But Friederich had scooped the idea by mentioning swift steam airships back in 1826.

S. C. GILFILLAN

Research Associate
University of Chicago

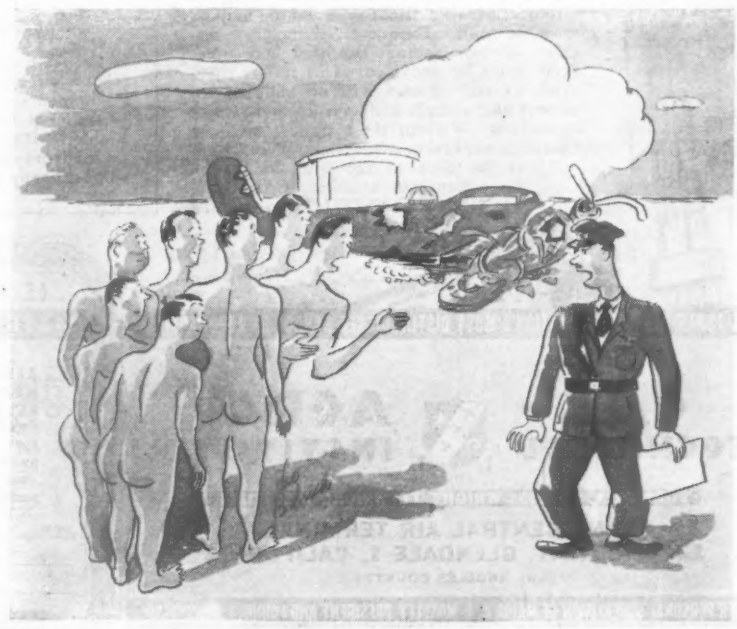
QUESTION TO MR. HOYT

Sirs:

John R. Hoyt's "Is The Stall Landing Obsolete?" in FLYING's May issue is of considerable interest to many readers. Wheel landings deserve more consideration than is generally given them in flight instruction.

One of Hoyt's assumptions could be misleading if incorrectly interpreted. He assumes the formula for free-falling bodies applies in calculating the velocity with which a plane strikes the ground when it is stalled at a given altitude. If a stall landing is properly executed, the wing is at the angle of attack corresponding to that of maximum lift, the lift being equal to the weight of the plane. As the airspeed and lift decrease, the plane "mushs" down but does not drop under the force of gravity alone. I think the average lightplane would be "plastered"

(*Continued on page 152*)



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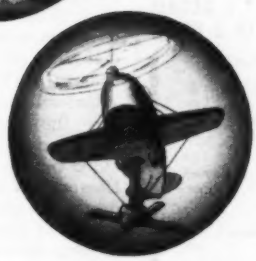

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Here's How to Run an Airport

(Continued from page 35)

us by a number of pilots who had visited this field on several occasions since its beginning in 1938.

Each phase of airport operation and facility offered the pilot customer depicted in "How *Not* To Run an Airport" was closely scrutinized at the Columbia airfield. The comparison proved further that the conditions prevalent at the majority of fixed-base operator airports can either be remedied or eliminated outright.

In place of the dilapidated, fire-inviting hangars previously visited, the offices, lounge and repair shops of the Hawthorne service were all housed in an attractive steel-and-brick hangar 100 feet square. A total of 36 aircraft are stored here, of which 24 are privately owned.

Hangar rent for lightplanes is set at $15 per month, with larger aircraft, Stinsons, Wacos, etc., hangared at $20 monthly. This contrasts strangely with rentals for comparable planes at the four airports surveyed in "How *Not* To Run An Airport." Rentals were from $5 to $10 higher at those fields. Those lightplanes at Hawthorne which are not hangared are assigned a unique wind-proof tie-down area with concrete tie-down spots and tail posts to permit parking the plane in level flight position. There is no charge for the tie-down area, whether the plane is permanent or transient.

This gratuitous service is supplemented by small niceties that bespeak the pride of the operator in his opportunity to serve the flying public and create immeasurable customer good-will. These services include cleaning the interior of the plane, wiping off the wing or cowling after servicing with fuel or oil, checking tire pressure and wiping off the windshield.

This prompts a mental comparison between the automobile "gas station" and the more efficient "service station." Car owners' expectations have all but made the "gas station" extinct and it should be remembered that they need not be permanent customers to receive similar courtesies from all stations. Both the service station and the fixed-base operator have the personnel to refuel the vehicle, ground or air. It costs no more to perform such minor services, but lack of them can readily create dissatisfaction and a definite impression of poor operation. Most service station operators know this to be true—most fixed-base operators have not learned it—at least not yet.

The variance in major overhaul rates between those charged by the four "average" airports depicted last month and the one at Columbia casts something more substantial than a shadow of doubt as to the methods used to arrive at a fair charge. In the metropolitan area first surveyed, major overhaul rates for engines of 65 h.p. were staggered from $180 to $500, the average being $350. Hawthorne estimates the major overhaul of a Continental or Lycoming 65-h.p. engine at $150 as an average, with the Franklin engine of equal horsepower at $25 more. Geographical differences in mechanics' wage scales hardly justify an increase of $200 for the same function—indeed, the superior facilities at Hawthorne might almost make it seem that a reversal of rates would be justified.

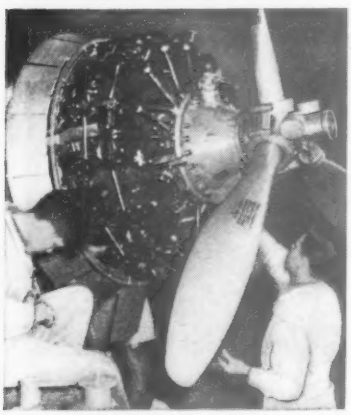
One revolting situation in "How *Not* To Run An Airport" was the lavatory situation. In contrast, view the clean, modern separate rest rooms for men and women at Hawthorne. As an added convenience, the men's room has a shower stall; the women's room has a full-length mirror.

A pilot's ready room and a main lounge are available at Hawthorne; they are improved by a recent expenditure of $2,500 to insure pilot and visitor comfort. This contrasts with the pine-planked benches in dirty, cold "lounge rooms" which bespeak an attitude of indifference to the customer by the average operator.

The chronic complaint that snack bars, restaurants and lunch rooms are totally ignored in the average operator's plans was reviewed in our prior article. The average small airport usually is devoid of facilities for feeding its customers. In too many cases where some means of serving food was hastily thrown together, the food was poorly prepared, generally cold and priced too high. Hawthorne's neat lunch room is operated by a concessionaire and provides wholesome, palatable food at prices in keeping with those prevailing in downtown Columbia. In brief, the creation of facilities, atmosphere and services appealing to the average person has been given prime consideration at this field.

To all appearances, this policy has paid dividends. In 1944, after taking flight instruction at Hawthorne, more than 150 persons got their private licenses. With an average of 145 lessons per week handled by the instructors and an average of eight to 10 transient pilots putting in at this airport each day, the investment in courtesy, cleanliness and co-operation has given Hawthorne an excellent reputation. It operates with a total of 25 persons—including administrative, instructors, mechanics and linemen.

Unfortunately, the type of airplane care, the type of customer-operator relations and the high degree of service provided here is the exception, not the rule. However, it proves that a businesslike approach to serving the private pilot of today—and tomorrow—not only will give impetus to aviation's progress, it will develop into a profitable business. It is



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WE Purchase for cash Diamonds, Watches, Jewelry, Silverware, Cameras, Projectors, Lenses, Accordions, Binoculars, etc. Take advantage of current high prices. Ship now. Payment made immediately. Purchases held ten days subject to your approval. Bank References. Buysell, Inc., 872 Sixth Ave., New York.

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Only by examining the faults of the average fixed-base operator and comparing them with the practical and profitable manner of operating an airport, will pilots *demand* the type of service to which they are entitled. It gives rise to the question that every pilot and private plane owner should ask himself—what kind of service am I getting now, and what kind do I want? END

Letters

(*Continued from page* 148)

to the runway if it hit the ground with a vertical velocity of 680 ft./sec.

I am very pleased to see you publishing articles of this kind.

J. C. MOUZON

Philadelphia, Pa.

WANTS AIRPORT PLANS

Sirs:

I am a reader of FLYING and enjoy it very much. I have been looking for an article on airport operation, since, like many other pilots, I have hopes of owning a flying business after the war. An article on airport construction, hangar design and cost, runway surfacing and the best types of material for runways in all-weather country, would be much appreciated by all of us.

LIEUT. FRANK E. EDWARDS

Harlingen, Tex.

● We plan to cover this subject in forthcoming issues. See "How *Not* To Run An Airport" in the June issue and its companion piece on page 35 of this issue—ED.

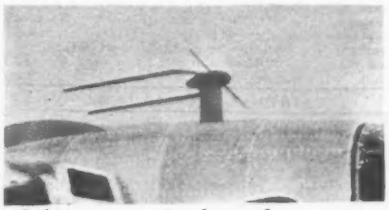
CAPTION CORRECTED

Sirs:

Your attention is called to an error in the caption accompanying the photo of the blind landing antenna system shown on page 75 of the April issue of FLYING.

The slender bar is for the glide path and the U-shaped piece for the localizer. This is the reverse of the description shown under the picture.

Because this is comparatively new equipment in the field and maintenance men are not yet completely familiar with it, it is felt that serious results may result from the incorrect caption. It is request-



ed that a correction be made as soon as possible.

MAJ. FRANCES C. BYRNES
Radio and Radar Subdivision
Wright Field, Ohio,
Engineering Division

● Sorry. That's the way it was described to us by one of the country's leading manufacturers.—ED.

DON'T FORGET RADAR

Sirs:

Maj. Oliver Stewart, author of "Is Battle-bombing Doomed?" in the March issue of FLYING, seems to think it is. Maybe so, but has he overlooked the importance of radar in his arguments? When the enemy develops radar to the same point we have he will also be able to engage our planes in combat at will, no matter what kind of cover they will be flying. That will mean that all bombers will be battle bombers.

CPL. ROY H. JAMES

APO, New York, N.Y. END

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